Rock Products

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# The Premier Gravel Plant of 1923

## Illinois Sand and Gravel Company's Plant Represents Years of Producing Experience and Is a Model in Design and Construction

By Gordon Smith
J. C. Buckbee Company, Engineers

THE plant of the Illinois Sand and Gravel Co., built in the early part of 1923 between Oswego and Yorkville, Ill., on the Fox river branch of the Burlington, represents the "last word" in the design and construction of sand and gravel washing plants and includes several outstanding features, which mark it the leading achievement in the industry for the year. Briefly these features are: Extensive yard facilities, steel construction and consequent freedom from vibration, large screening area and the speed with which the plant was brought to maximum production.

The deposit is excellent, and consists of about 330 acres, averaging 20 to 25 ft. in depth, overlaid with but 2 to 2½ ft. stripping. The material is of high quality, the sand being exceptionally coarse and sharp, the gravel clean and hard. The average of some 30 test holes put down to the underlying rock or clay shows the following analysis of the bank:

| | Per cent |
|---|---|
| Over 2½-in. | 23 |
| Through 2½-in., over 1-in. | 28 |
| Through 1-in., over ¼-in. | 19 |
| Through ¼-in. | 30 |
| Total | 100 |

This deposit, which contains approximately 16,000,000 tons, is leased from the Chicago, Burlington & Quincy railroad by the Illinois Sand and Gravel Co. This company, as lessees, built the plant which is operated under agreement by the Chicago Gravel Co., for whom E. W. Renwick is general superintendent and Roy Ketcham, plant superintendent. The officers of the Illinois Sand and Gravel Co. are: F. W. Renwick, president; L. P. Yale, vice-president; Geo. B. Hart, treasurer, and M. D. Huckins, secretary.

The track facilities, as shown by Fig. 1, are simple but comprehensive, and pro-

*Fig. 5—This shows the all-steel construction of bins and supports, the screening system, the main belt conveyor, which carries material from the track hopper, and the conveyor (in front) which returns material from secondary crushers*

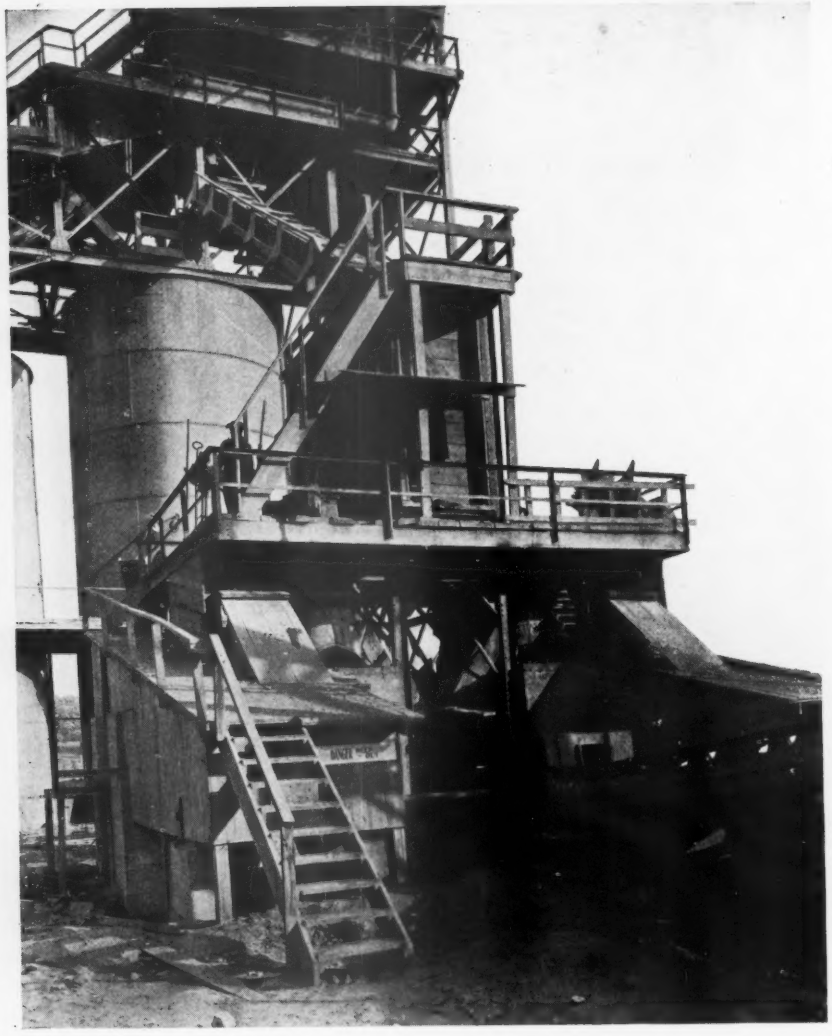


***Fig. 6—Detail of crushers and feed bin. On account of foreshortening in the photograph the oversize return chute appears much flatter than in Fig. 5***

vide the maximum of convenience in the handling of loaded and empty cars. As may be noted, facilities are also provided for moving the pit equipment into the shop for repairs. A total of about 16,000 ft. of standard gage track were laid in the building of these yards and room is provided for the storage of 97 cars in the empty yard and 106 cars in the load yard. Cars are moved past the loading bins by gravity, and a 20-ton Browning locomotive crane is available for switching and general yard use. A 50-ft. 100-ton railroad track scale is situated between the plant and the load yard.

The pit equipment consists of a Page Engineering Co. class 424 dragline excavator with 100-ft. boom and 4-yd. class C bucket. The pit cars, which are similar to those used at other plants of the Chicago Gravel Co., are Sommers dump cars of 100,000-lb. capacity. Two 50-ton standard gage switching locomotives are used for pit haulage. Fig. 2 shows the gravel train at the dragline. The deposit is being opened up to work a long face approximately parallel to the loading tracks and the material is delivered to the track hopper on the "high line." Fig. 3 is a general view of the plant in which the gravel train is shown at the hopper.

### *Peak of Production in 30 Days*

Construction work was begun late in 1922 and carried on throughout the early months of 1923 under the supervision of E. W. Renwick, and despite much loss of time due to inclement weather was completed and put in operation on June 10, 1923. The peak of production for the year was reached with a record of 87 cars loaded in 10 hr. within 30 days after production was started and a high daily average has been maintained throughout the season.

The plant was built from plans and specifications prepared by the J. C. Buckbee Co., Engineers, Chicago, and the general design is the product of Mr. Renwick's 15 years of operating experience and the engineers' 18 years of experience in the design and construction of sand and gravel washing plants.

The track hopper is of reinforced concrete throughout, 19x48 ft. in plan, and has a live capacity of more than 200 cu. yd. The tracks are carried on steel I-beam stringers. A grill of railroad iron, with clear openings 12 in. square, protects belt and screens from damage due to large rock. A special heavy mine type hopper gate with 24x30-in. clear opening feeds the main 36-in. belt conveyor delivering at the head of the plant. This conveyor runs at 384 ft. per minute and at an angle of 18 deg. from the horizontal, the centers being 266 ft. The carriers are of a special design developed by the Chicago Gravel Co. and made expressly for it. This conveyor is driven from a 75-hp. motor at the head of the plant, which motor also furnishes power for the gravel screens.

These 20 screens are cylindrical in form, 42 in. in diameter and 10 ft. long. The design was developed by Mr. Renwick and is used in all plants operated by him. The screen consists of two cast-iron spiders mounted on a heavy through shaft, the

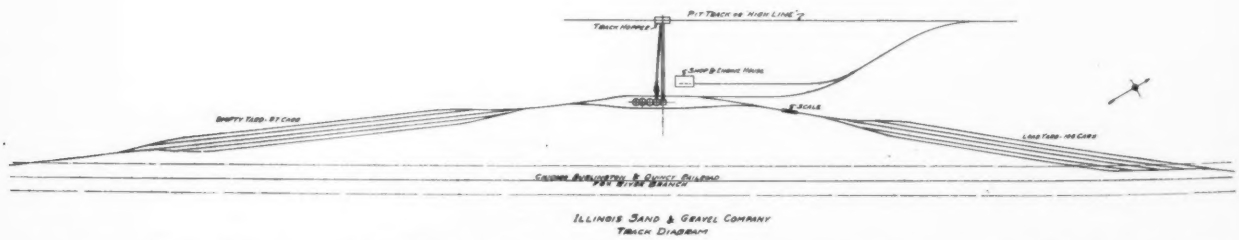



***Fig. 1—The map shows the ample trackage with room for 97 empties and 106 loads. Cars move past the loading bin by gravity. A total of 16,000 ft. of standard gage track has been laid in these yards***

spiders carrying the steel screen sheets and lifting plates. The screens are set in banks of four each, set on 4-ft. centers. Each screen carries a 48-in. pitch-diameter gear meshing with that of the screens on either side and one screen of each bank is driven through chain and sprocket from the lay-shaft. Chain drives are provided throughout on the screens from the head shaft of the main belt conveyor.

### *Four Hundred Acres of Screen Surface in a Ten-Hour Day*

The total area of the 20 screens is 2200 sq. ft. and inasmuch as the screens turn 13 revolutions per minute the enormous area of 1,716,000 sq. ft. of screening surface is presented every hour, or nearly 400 acres in a 10-hour day!

The screens are followed by four 6x6x7-ft. deep, balanced, timber sand settling boxes arranged on steel frames so as to permit easy adjustment in any direction to secure the most efficient operating positions.

The first bank of screens act as scalpers, the gravel over 2½ in. in size being rejected to the recrusher plant, consisting of two No. 5 and two No. 4 Traylor crushers. The oversize gravel is delivered through a timber lined steel frame chute to the crusher bin of similar construction from which a steady even feed is maintained to all crushers. The four crushers are belted from a single line shaft driven by a 150-hp. motor. The product is returned to the track hopper on a 24-in. belt conveyor driven by a 20-hp. motor located in the small head house at the hopper.

### *All Supports of Steel*

The conveyor galleries, crusher bins and superstructure over the bins are all of structural steel. The conveyor galleries and all platform and stairs throughout are guarded by angle iron or pipe hand rails, with heavy plank floors and treads. The value of the steel construction, aside from its permanence and negligible maintenance cost, is readily apparent in the absolute lack of vibration in the entire structure, despite the hammering load of the long belt conveyors and the large revolving screens.

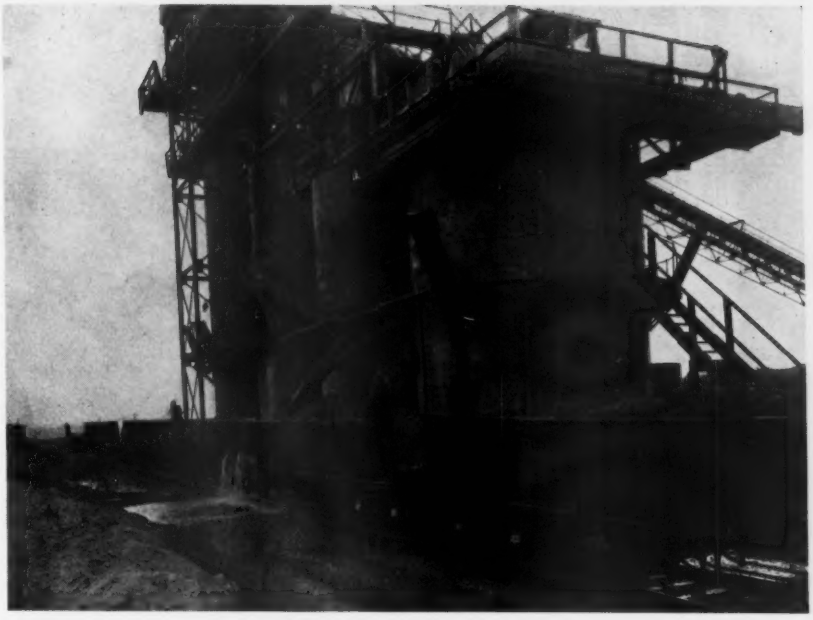


***Fig. 7—The spouts on the loading bins permit loading separate products or of a mixed product from two bins to the same car***

The loading bins, which are of the tank type, (see Fig. 7) are four in number, each 20 ft. 0 in. in diameter and of steel plate construction. Their aggregate *live* capacity is about 1050 tons. Each tank has four loading gates and spouts, two on each side, set at an angle to facilitate mixing in the cars when this may be required. The chutes under the screens are of timber, lined with steel plate, and are arranged to separate four sizes of gravel and one of sand or to mix the product to meet railroad ballast specifications.

### *Water Supply*

Water for washing purposes is secured from the Fox river at a distance of about 3000 ft. The pumping station equipment consists of two American Well Works double suction 6-in. centrifugal pumps direct con-

***Fig. 3—General view of plant with gravel train at hopper***

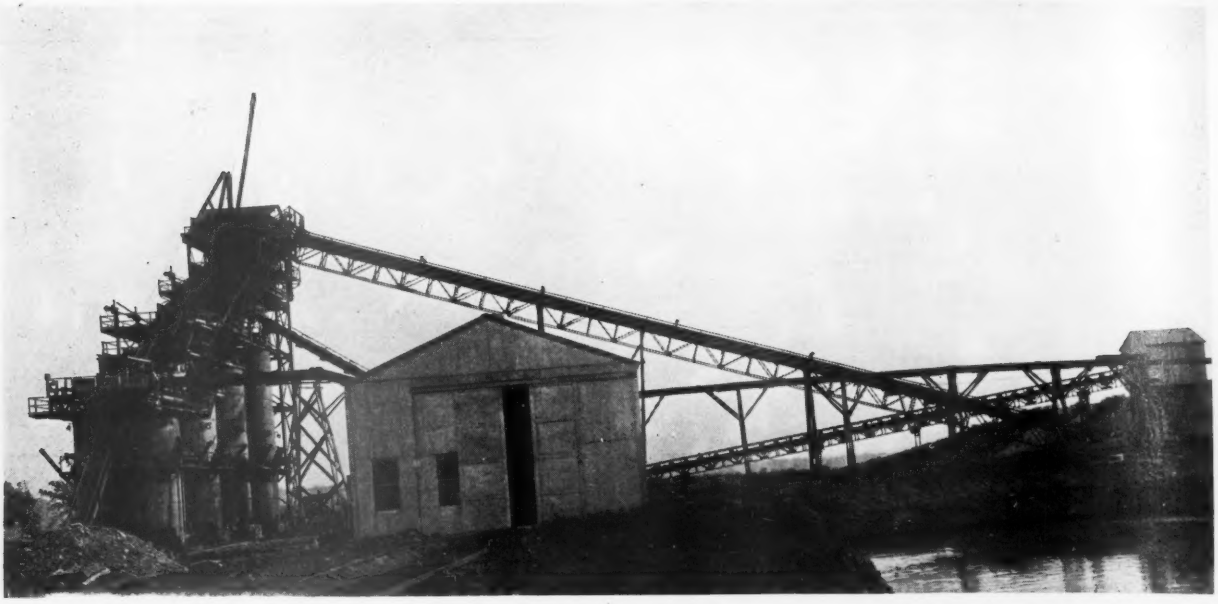


*Fig. 4—This general view gives an excellent idea of the all-steel construction resulting in freedom from vibration*

nected to 75-hp. motors. The capacity of each of these pumps is 1000 gal. per minute at 180-ft. head, and they discharge into a common line of 12-in. spiral riveted pipe leading across the pit, underneath the track hopper and along the main belt conveyor gallery to the head of the plant.

The shop building and engine house is 36x60 ft. and 20 ft. high to the eave line, of steel frame construction, with corrugated covering and steel sash. The shop track is connected to both pit and loading tracks to permit running any equipment inside the building for repairs.

### *Electrically Driven Throughout*

The plant is electrically driven throughout and power is supplied by the Western United Gas and Electric Co., of Aurora, by means of a 13,000-volt transmission line from Yorkville. The plant substation steps down the voltage to 440 volts for all motors. Motors were supplied by the Western Electric Co. and wiring materials by the Central Electric Co., both of Chicago.

The Stephens-Adamson Mfg. Co., of Aurora, furnished all transmission and conveyor driving machinery. Conveyor belts were supplied by the Hewitt Rubber Co. and the Victor Balata and Textile Belting Co.

The Milwaukee Bridge Co., of Milwaukee, was the contractor for the structural steel work and the Hamler Boiler and Tank Co., of Chicago, for the steel plate tanks. The concrete work was put in by the Powers-Thompson Construction Co., of Joliet, Ill., under the direction of Mr. Renwick and Mr. Ketcham, who also installed and erected all machinery and electrical work.

While this plant embodies nothing radically new or different in general design, the worth of close attention to details and operating convenience on the part of those responsible for the design, is proven by the ease and speed with which peak production was attained and the high daily production average maintained throughout the operating season.

Plans for the near future provide for the doubling of the pit equipment and a corresponding increase in the plant production and, based on this past season's experience, an average daily production of 100 cars is anticipated.

*Fig. 2—Gravel train at the dragline, which has a 4-yd. bucket. The cars are 50-ton and standard gage*

# Latest in Lime Hydrating Plants

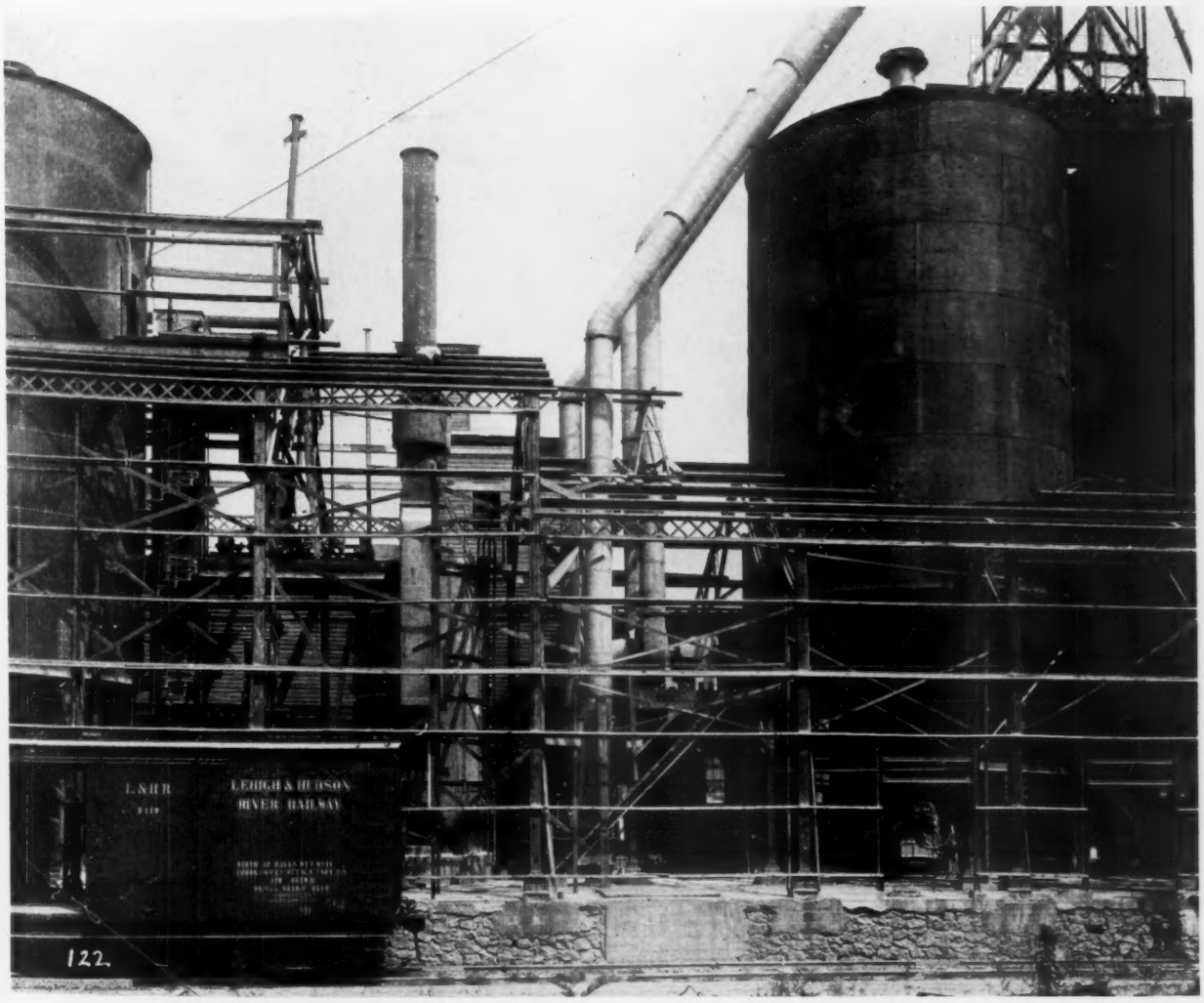
## Palmer Lime and Cement Company, York, Pennsylvania, Has Most Interesting Plant Built in 1923—Also Claims Record for Most Economical Lime Plant

THE PALMER LIME AND CEMENT CO., New York City, with plants at York, Penn., and Oranda, Va., is possibly one of the livest lime-manufacturing organizations in the United States; and it is certainly one of the best known, both in this country and abroad. Always one of the most progressive in the adoption of new ideas and new methods, its York plant stands out prominently in the year 1923, as having completed a hydrating unit which is about the last word in recent progress along these lines.

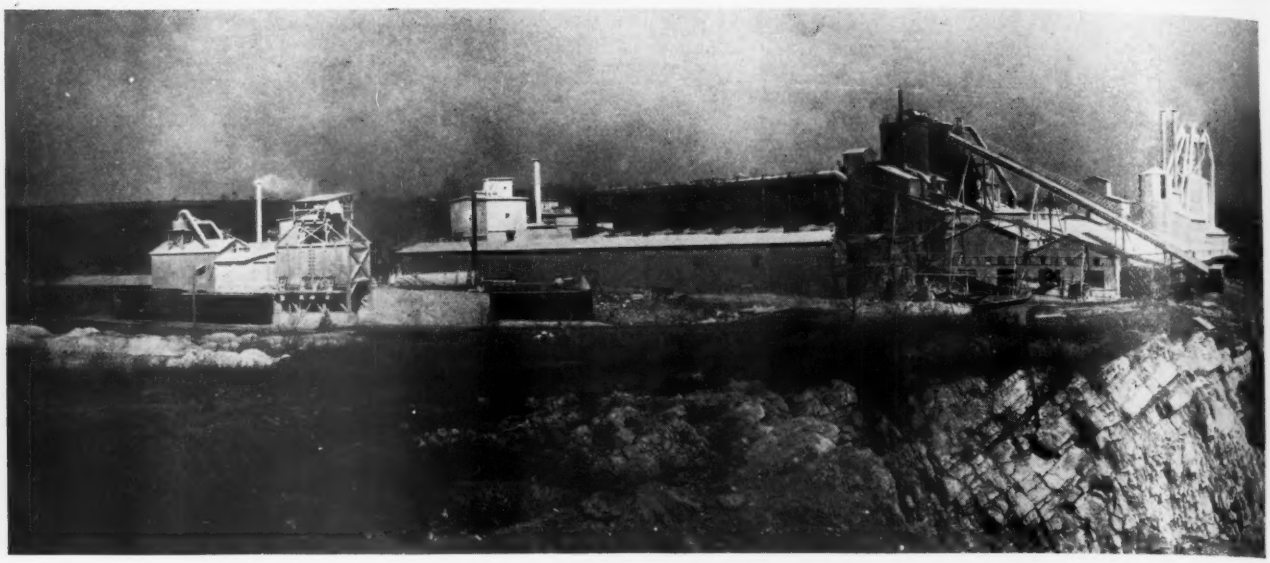
### *General Plan*

The map, Fig. 1, gives a good general idea of the approximate positions of the quarries, lime kilns and hydrating plant. The two panoramic views also give an idea of the plant as a whole, which is necessary to an understanding of what follows.

The plant as a whole consists of six practically separate and distinct units: (1) A drying, crushing, pulverizing and shipping plant for ground limestone (at the left of the panorama); (2) a battery of ten special Keystone lime kilns erected in 1907, coal fired, with special lime-drawing equipment installed in 1923; (3) a battery of two very large kilns—the largest shaft kilns ever built—erected in 1912; (4) a lime-hydrating plant built in 1923 to replace one of the first large hydrating plants ever built in this country (in 1907); (5) a lime storage and shipping shed; (6) a precipitated calcium carbonate plant, where chemically pure calcium carbonate is manufactured for special purposes. Not included in the above outline is a cooperage plant operated by the International Cooperage Co.




*New hydrating plant of the Palmer Lime and Cement Co. at York, Penn.*



*Panorama of the York, Penn., plant of the Palmer Lime and Cement Co.*

The precipitated calcium carbonate plant is running day and night to take care of orders, and the plant capacity is being increased. Over half the tooth paste and tooth powder manufactured in the United States contains calcium carbonate made at this plant.

The limestone pulverizing plant is at present being enlarged and improved. Four large steel tanks of 1000 tons capacity each are being erected. An additional highside Raymond mill is on the ground which will be erected as the present Raymond mill is not able to take care of the demands. A new crusher that will have a capacity of a thousand tons a day and a Ruggles-Coles drier to be used in the winter time to dry this stone before it is pulverized are being installed.

A large rotary kiln, in which oil-burning equipment will be used, will handle and dispose of spawls, which will eventually be put up in barrel form or hydrated—surely making an all-round complete plant.

### *Kilns*

The ten Keystone kilns are fired from two furnaces each, with a modified Eldred system of combustion whereby the gases from the tops of the kilns are returned, by means of fans, to the fire boxes, and serve to temper or dilute the flame from the burning coal. These kilns deliver 12 to 15 tons of real lime (excluding core, etc.) per day of 24 hours. Their average fuel ratio is 4 to 1. The coal used is West Moreland gas slack of about 14,000 B.t.u. Owing to a

*Another panorama showing more of the quarry; the hydrating plant near center;*

*Limestone pulverizing plant at the left; hydrating plant at the extreme right*

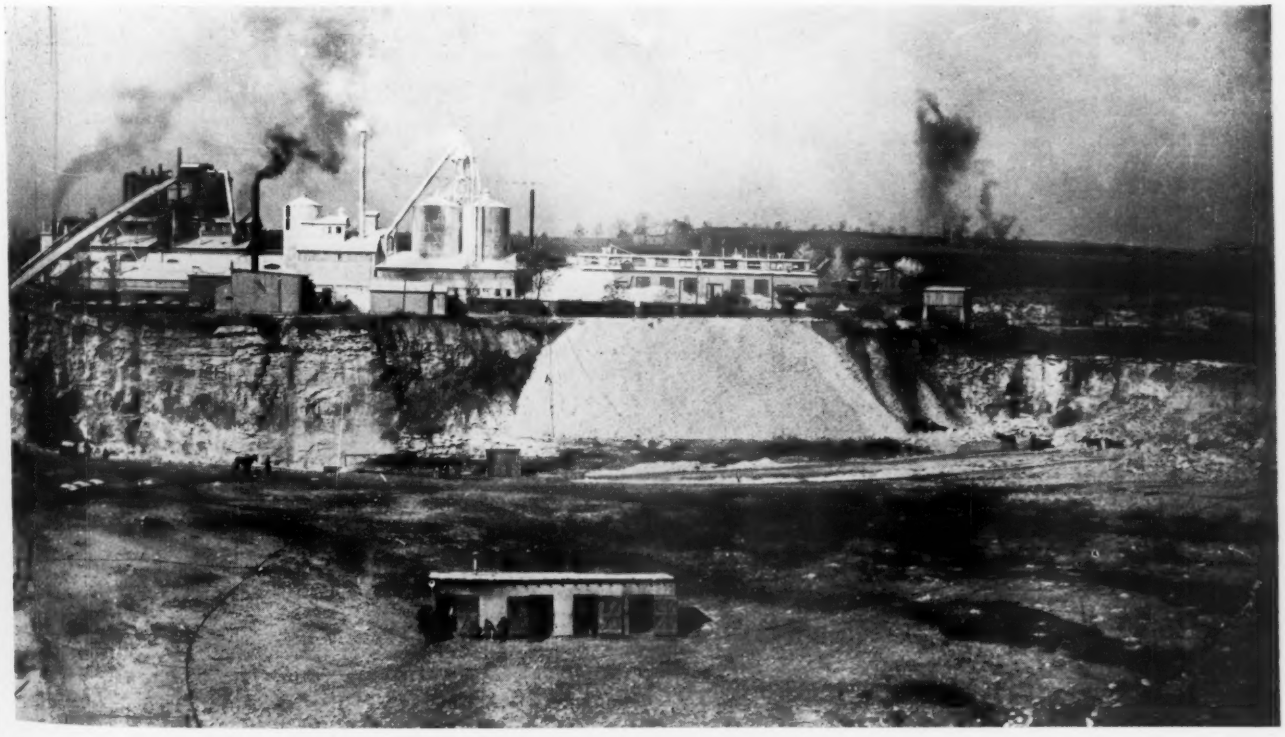
special design of the drawing cone (They are built rather shorter than is the common practice today.) the lime is drawn hotter than desirable. Recently one of the kilns has been equipped with a standard York type cooling cone and its efficiency is being closely watched.

The big kilns are fired by four R. D. Wood & Co. 12-ft. diameter gas producers, hand-poked, two to each kiln (one at the middle of each side). Forced draft is used. These immense kilns deliver from 75 to 100 tons of real lime a day, excluding core, which ordinarily does not exceed 1 per cent. These kilns give a fuel ratio of 5¼ :1 day in and day out, and they are operated a full 12 months without relining. They are, so far as known, the most economically-operated lime kilns in America.

The big kilns are 26 ft. 6 in. inside diameter and 100 ft. high, holding 1000 tons of limestone at a time. The lower part of the kiln is divided by a vertical wall, or diaphragm, and the system of gas inlets is complicated, being especially designed for these kilns, and is patented.

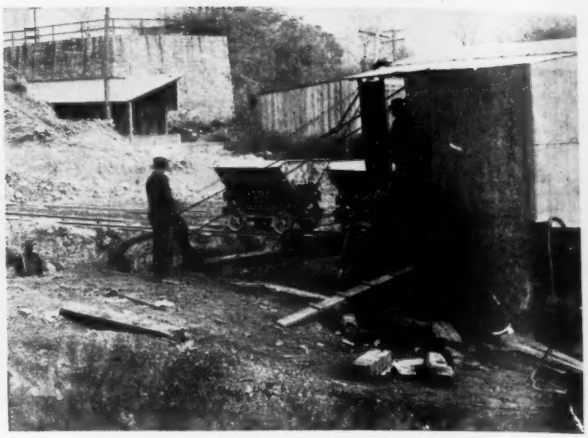
### *Comparative Economy of Small and Large Kilns*

The battery of ten small kilns make, or could make when all are in use, 120 to 150 tons of lime per day. The arches and fire boxes have to be relined once in every nine months. To operate them requires five firemen, one draw man, and one ash removal man per shift. In addition to

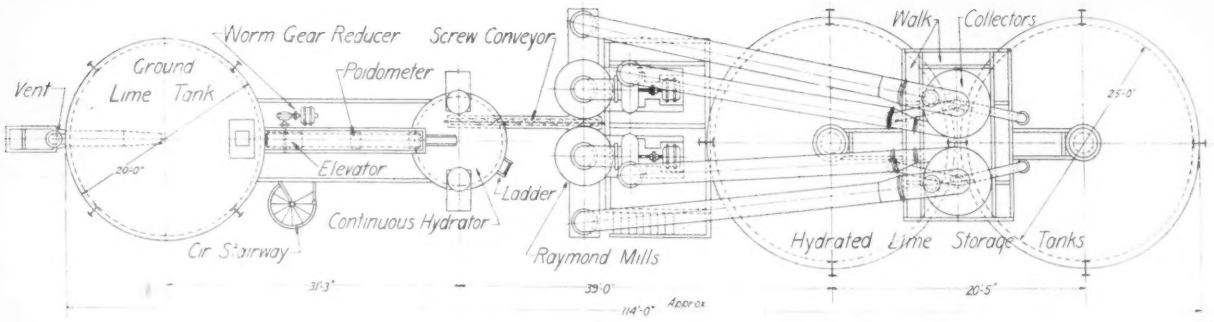


*the plant for making chemically pure calcium carbonate at the extreme right*

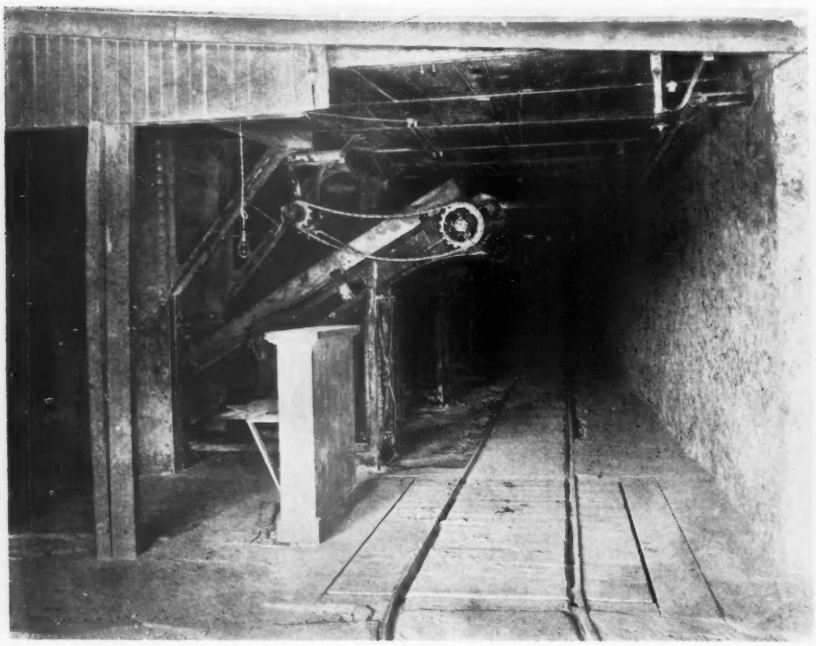
*Quarry to plant transportation methods*



*Keystone shovel for stripping overburden*

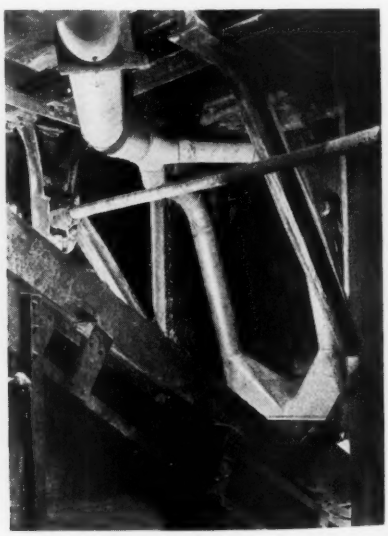



*Plan of the hydrating plant showing various special details*

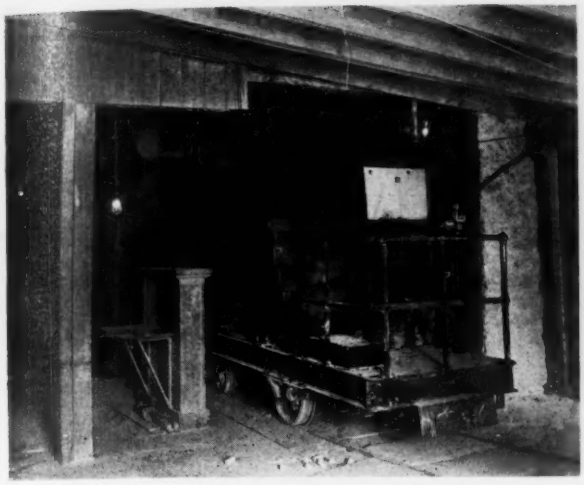


*Link-Belt pan conveyors installed under battery of lime kilns for mechanical drawing of hot lime*

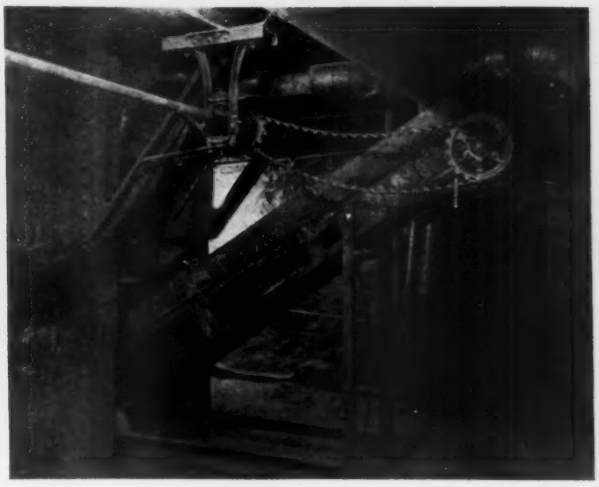
*Note the track scales in the view to the left for weighing every pound of lime drawn from the kilns*



*Dust collecting system on battery of Keystone kilns. This view shows the intake at the shears of the cooling cone on one of the kilns*



*Trolley car of two tons capacity for handling lime*



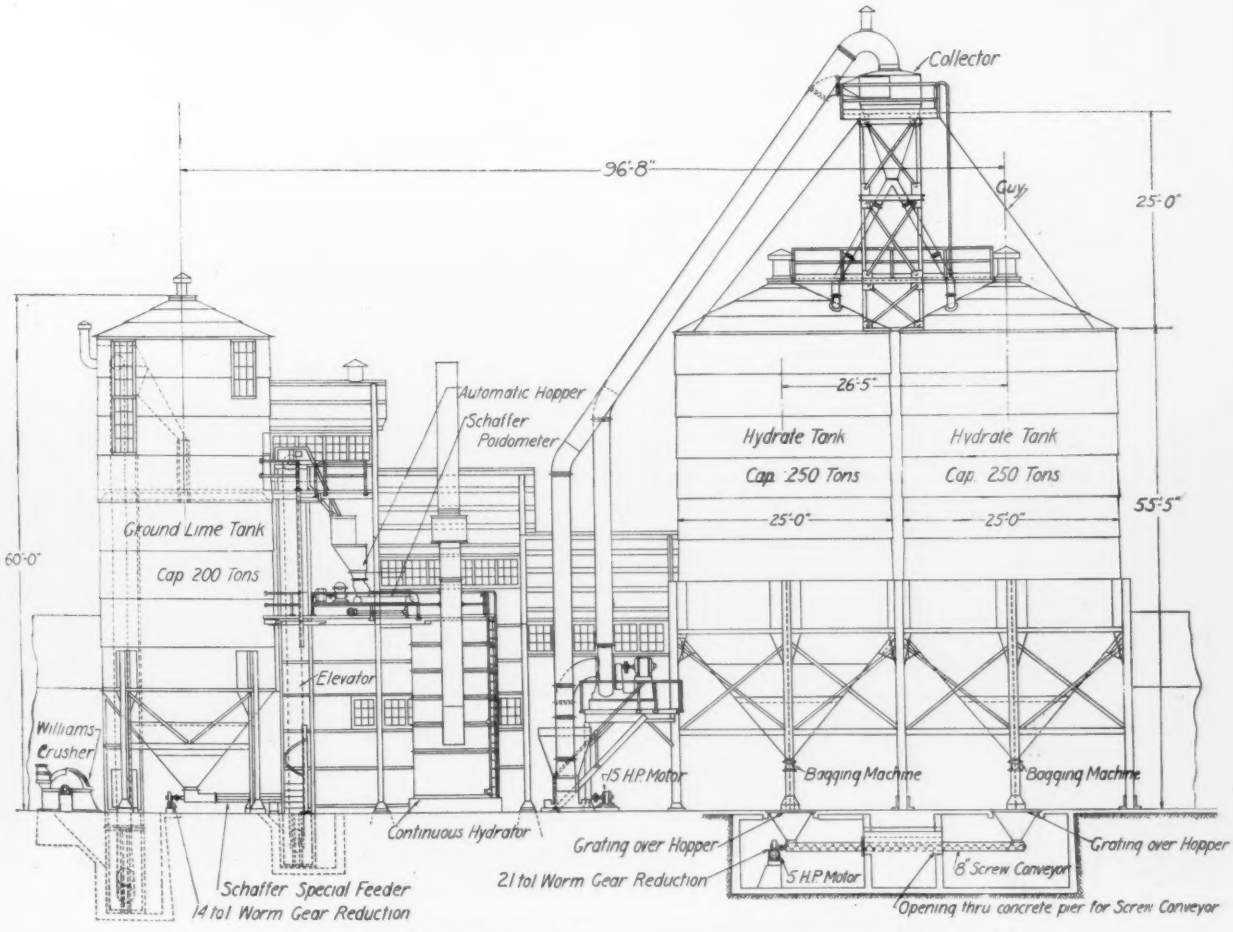
*Near view of lime-drawing conveyor and dust collector*

these kilns are three exceptionally large pot kilns of about 10 tons per day capacity each. Most of the lime from these pot kilns is used for building in and around York.

To operate the two big kilns to produce from 150 to 200 tons of lime per day requires 4 firemen per shift, 1 draw man, and 1 ash remover. The same foreman looks after both large and small kilns. So besides the much greater fuel economy there is a clear saving of one man per shift per day for a considerably larger output of lime (and better lime at that).

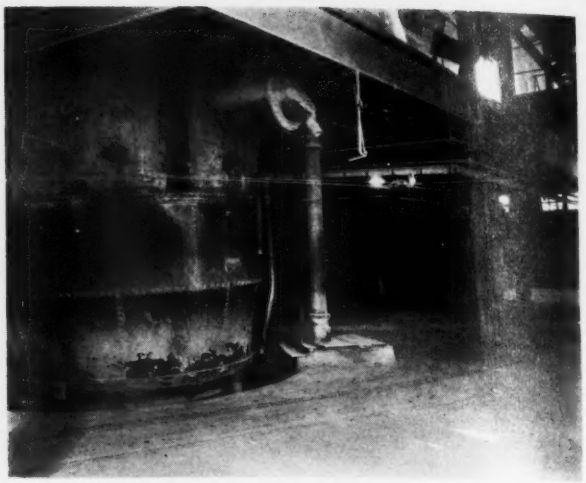
To overcome this labor handicap, Lowell M. Palmer, Jr., president of the company, is already planning to install oil burners on the ten smaller kilns; and if proved satisfactory, oil burners will probably be eventually installed on the large kilns also.

Under date of December 26, Mr. Palmer

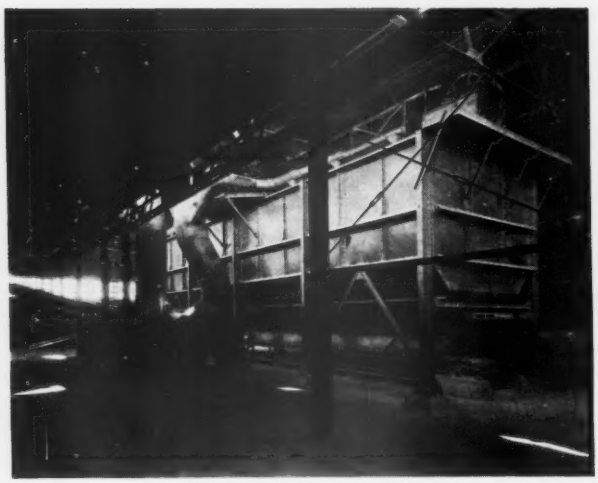



*Elevation of hydrating plant from lime crusher to packing machines*

*Firing floor of gas producers on the big kilns*



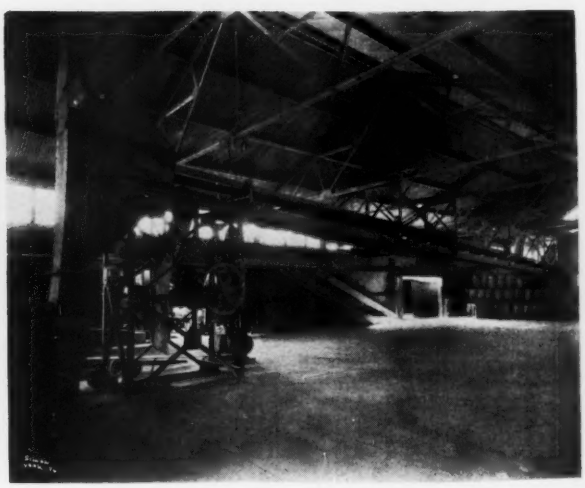
*Gas producers—two on each side of kilns*



*Lime-cooling bins; conveyor below and on the left is conveyor to the barreling machines*

*Opposite end of cooling bins showing lime going to barreling machines at the right*

*Barreling machines with screens for removing fines; fines and culls go back on belt conveyor in foreground to hydrator*



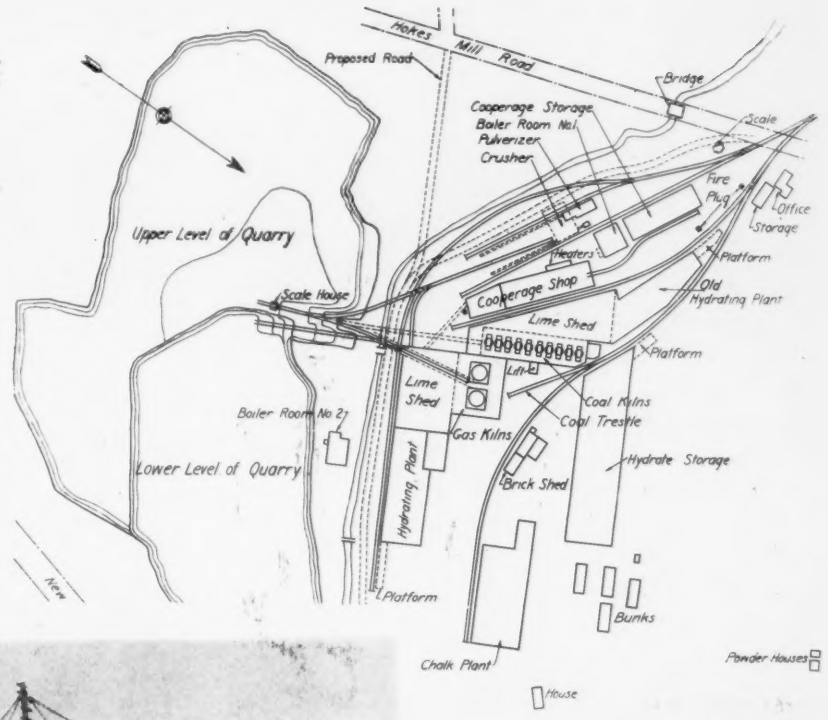
*End of belt conveyor feeding crusher ahead of the hydrator; screw conveyor at left brings fines from dust collector bin*

informs the editor by letter that he expects to have his oil-burning apparatus operating by the first of the year. From the trials made he is convinced that he will greatly increase his output and expects to run the entire battery of kilns with two firemen on shifts of 12 hours, thereby eliminating eight men. The ash man will be removed because there will be no ashes when oil is used and a drawer man will be eliminated because he would be unnecessary.

### *Lime Drawing and Dust Collection*

One of the improvements completed in 1923 which makes a big labor saving over former methods of operation was the installation of Link-Belt lime-drawing equipment on the battery of ten small kilns. This installation consists of 18-in. inclined steel pan conveyors under the draw shears of each kiln, as admirably illustrated in one of the accompanying views.

Air intakes for dust collection, or rather dust prevention, are provided at both the intake and discharge ends of these conveyors, as illustrated in two of the accompanying views. A 40-in. Sturdevant fan at the far end of the battery of kilns provides the suction for the intakes. The main intake is 12-in. galvanized pipe and the kiln intake 6 in. The lime dust is not recovered but discharges into the air outside. A similar dust-prevention system is provided at the draw shears of the large kilns.

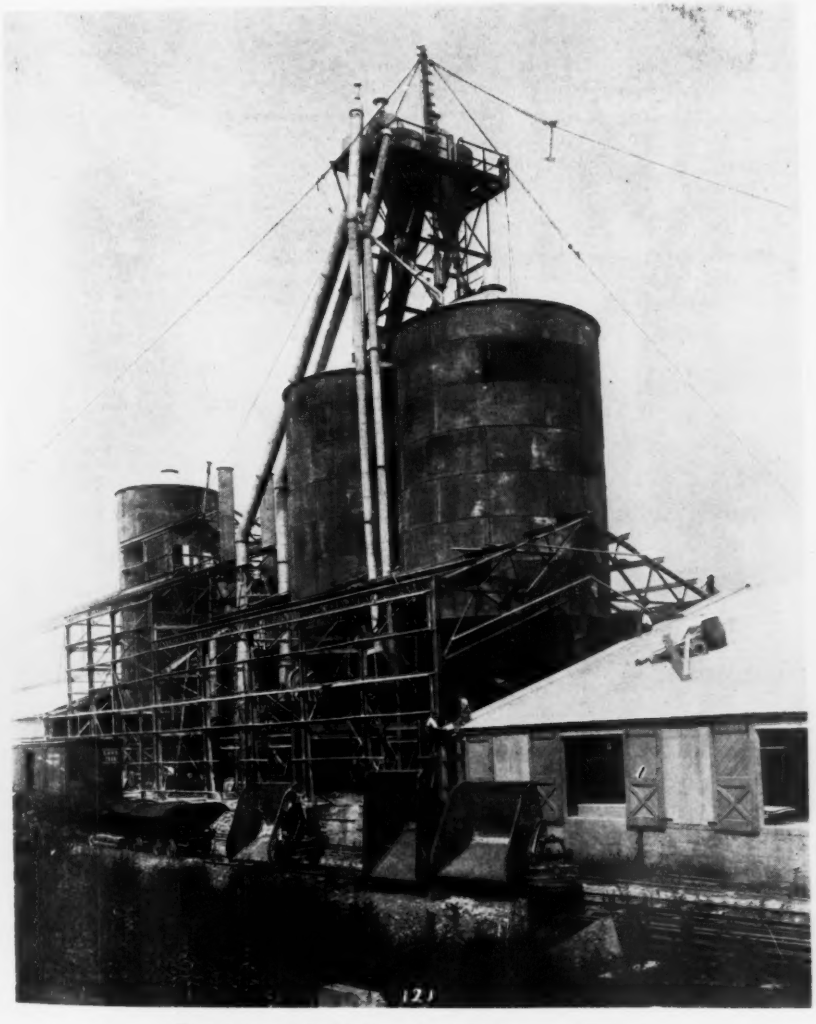



***Map of the whole plant of the Palmer Lime and Cement Co.***

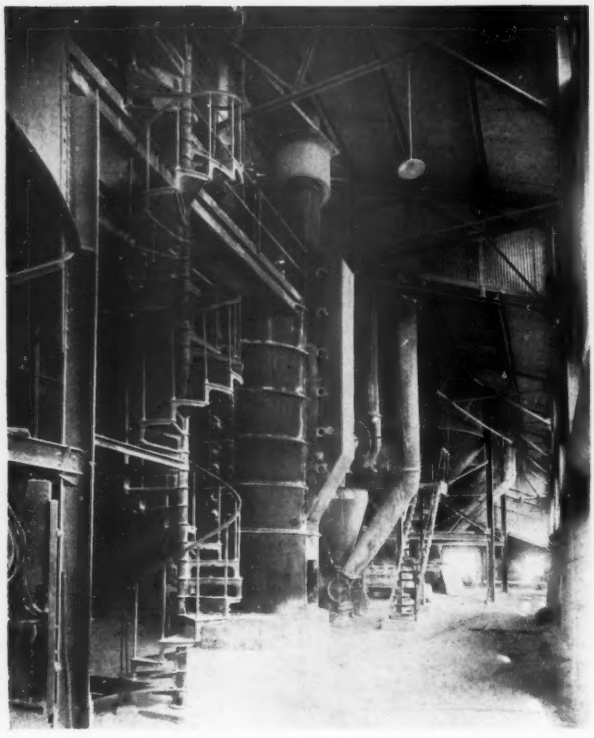
The pan conveyors from the battery of small kilns discharge into a 2-ton electric trolley car running parallel to the kilns. This car is shown in one of the views. Before going to the lime bin every car of lime is weighed, as the lime burners are paid on a piece-work basis. Lime is drawn from the large kilns into small industrial railway cars and pushed by hand to the dumping hopper alongside the lime-cooling bin.

### *Pulverized Lime Storage Bin and Hydrator*

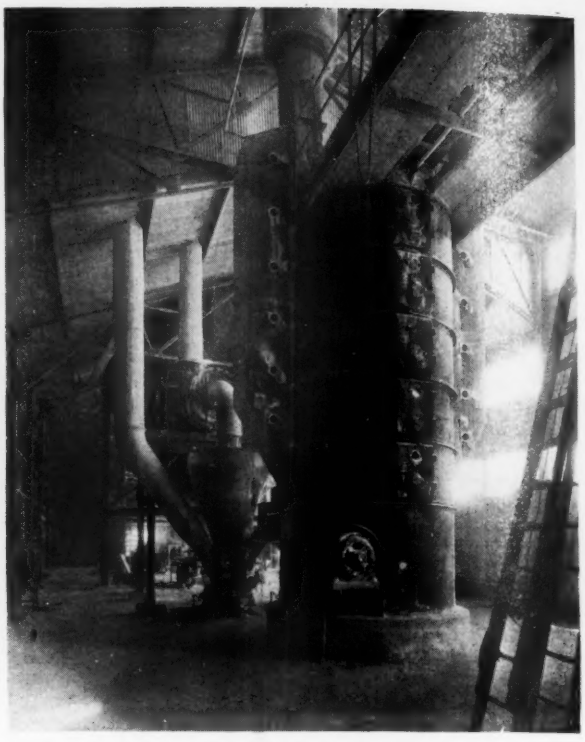
The cars of lime are dumped into a steel hopper in the floor of the lime plant, from which the hot lime is fed to a 20x24-in. bucket elevator by a 5-ft. reciprocating feeder. At the top of the 500-ton rectangular steel lime-cooling bin a special distributing conveyor delivers the lime over the entire length of the bin, which is divided into five compartments. A 70-in. Sturdevant fan and intake system removes the dust in handling the lime into and out of this bin, and this dust joins the hydrator feed at the lime pulverizer.



***End view of hydrating plant under construction***



*Interior view of hydrating plant showing Schaffer hydrator in the center*



*Another interior view of the hydrating plant showing hydrator in the foreground*

From the lime-cooling bin the lime is drawn through feeder gates at the bottom to a pan conveyor which delivers the lime to barreling hoppers on the side of the bin parallel to the hydrating plant. Here the lime is screened and sorted and the culls and fines go by a belt conveyor to a 42-in. Williams hammer mill for preparation for hydrating. From this point the course of the lime through the hydrating plant may be followed by reference to the plan and elevation shown herewith.

The discharge from the Williams mill goes up a 12x7-in. enclosed bucket elevator having a rated capacity of 57 tons of ground lime per hour, at a travel speed of 240 ft. per minute, to the top of the 200-ton ground lime bin or tank.

From the ground-lime tank the lime is fed out at the bottom through a screw feeder and conveyor (Schaffer special feeder) to an enclosed 10x6-in. bucket elevator having a rated capacity of 35 tons of ground lime per hour, at a travel speed of 245 ft. per minute.

From this elevator the lime is fed through a Schaffer automatic hopper to a poidometer, which is an automatic device for proportioning both lime and water. The poidometer feeds directly into a No. 1 special Schaffer continuous hydrator. This particular hydrator is the latest in the builder's art and is equipped with special devices for dust recovery. It has a capacity of about 20 tons of hydrate per hour.

The discharge from the hydrator is fed by a screw conveyor to a battery of two No. 3 Raymond mills and air separators, which discharge into two hydrate storage tanks of 250 tons capacity each. Below each hydrate bin is a four-way P tes valve-bag packer with a dust-recovery system as shown in the accompanying elevation.

### *Steel and Concrete Throughout*

The hydrating unit was designed by John C. Schaffer, as president of the Schaffer Engineering and Equipment Co., now of the Schaffer Engineering Co., Pittsburgh, Pa. The steel work and plant as a whole were designed and fabricated by the McGann Manufacturing Co., York, Penn., under the supervision of William J. Kuntz, vice-president and general manager. The lime-handling, conveying and related machinery was designed and installed by the Link-Belt Co., Philadelphia, Penn. The hydrator, poidometer, and accessories, were designed, manufactured and installed by the Schaffer Engineering and Equipment Co., Pittsburgh, Penn.

### *More Development in Prospect*

The plant at York also includes a Kritzer hydrator installed some years ago. With the two hydrators in operation the total capacity for making hydrated lime is 35 tons per hour. A good portion of this will be used in making plaster and it is hoped shortly to have a new Broughton mixer, which is the largest that has yet been made, in place to turn out this product. It is interesting to note that the National Lime Association is erecting its new experimental lime-block plant on the property, where the tests will be made and manufacturing experience will be acquired on the lime block which has been developed by Mr. Ferrett.

A large steam shovel is being installed at York because the operation is just getting to the point now where it can use a quarry steam shovel to good advantage.

A very high-class chemical laboratory is maintained where tests of all the products are being made and constant effort directed to improve them.

The president of the Palmer Lime and Cement Co., as already noted, is Lowell M. Palmer, Jr., 103 Park Ave., New York City. Besides the plant at York, Penn., the company owns and operates another modern plant at Oranda, Va. Three new kilns are being erected at Oranda. A hydrator is being installed and a large ground lime plant with steel bins of 1000 tons capacity. A crusher is being put in and other important changes made. The cooperage shop at Oranda is designed for a plant having an ultimate capacity of 2000 bbls. per day. Cleason G. King, York, Penn., is the general manager of the Palmer Lime and Cement Co.

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THE EDITORS have given more space in this issue to modern lime plant developments than perhaps the space available justified; but, as they see it, the lime industry will undergo more changes in manufacturing methods—some revolutionary—in the next few years than any other one of hte rock products industries.

# Review of Phosphate Rock in 1923

## Low Price Compels Producers to Thoroughly Investigate Production Methods and Costs and to Make Changes Which Reduce Expenses

By James A. Barr
Consulting Engineer, Mt. Pleasant, Tenn.

IN general, the first half of 1923 was a very prosperous one for the phosphate mining and fertilizer industry as a whole, but the latter half was below normal along with the balance of industries of the country. As the new year approaches, conditions are improving rapidly and prospects are much better for the coming season.

The continued drop in farm products prices hurt the fall fertilizer trade and the uncertain foreign situation and non-improvement of foreign exchange together with the development of a new source of phosphate in Africa, all combined to curtail phosphate rock production. While the above depressing factors are important, still the harmful effects of continued political propaganda and agitation against the so-called "fertilizer trusts" and the high fertilizer prices has had a great deal to do with this year's depression. Even a casual inspection of the highly competitive sales methods of both phosphate rock and fertilizers, together with the very poor financial showings of all fertilizer companies would show the unfairness of such agitation.

A compilation of average phosphate rock production figures, together with an estimate of the 1923 output, is given below.

AVERAGE PRODUCTION U. S. A. 1910-1922 INCLUSIVE

| | Tons |
|---|---|
| Florida | 1,829,833 |
| Tennessee | 447,661 |
| All others | 359,262 |
| Total U. S. A. | 2,636,756 |

ESTIMATED PRODUCTION FOR 1923

| | |
|---|---|
| Florida | 2,000,000 |
| Tennessee | 282,000 |
| Tennessee and Florida | 2,282,000 |
| Comparison with above for 1910-22 (avg.) | 2,277,494 |

The sales prices during 1923 were firm and slightly stronger in Florida and firm with no concessions in Tennessee. The selling prices are now entirely governed by production costs, and it is only by very close attention to operating details and economies that it is possible to show a profit at the present market. The continued low price has enforced a careful scrutiny of all methods in use and a careful search by engineers and skilled operators into all possibilities of cost reduction and improvement of recoveries.

No new plants have been erected in Florida during the year and general construction there has been at a low ebb. New work has been limited to a general run of replacements, such as is necessitated by mining out around existing washers and other renewals that were necessary to economical production.

A new plant for the manufacture of phosphoric acid and double superphosphate is to be erected on Tampa Bay just south of Tampa, in which the Dorr counter current system will be used. Sulphur will be brought in by boat for the manufacture of sulphuric acid and fuel oil delivered by tankers. Construction work has not been started.

The costs of removing overburden has been extensively investigated during the year and comparisons made of the hydraulic method and the use of dragline excavators, which have been decidedly in favor of the latter. This is especially true where hard pan occurs in the overburden that is necessary to drill and shoot and sometimes further break up by hand before the pump which takes away the hydraulicked material will take it. Occasionally there will be found deposits of soft sand that can be handled cheaper by hydraulicking, but this is the exception instead of the average.

### *Stripping with Draglines*

One company after having tried out draglines for several years is now preparing to do all of their stripping with these machines. One of the largest factors in the favor of draglines is the saving of power, and it is well known that where power costs are dependent on fuel, this item has been continually increasing in the past and will continue to do so.

For the Florida conditions, the size of dragline used is dependent on two factors mainly, i. e., the depth of overburden and the yardage required to keep ahead of a pumping outfit. A medium size dragline with 110 to 125-ft. boom and handling a 5- and 4-yd. bucket respectively is generally applicable to average conditions with 25- to 30-ft. depth of overburden and a maximum yardage of 90,000 to 100,000 per month. For conditions in excess of the above, the largest size machine is used, which mounts a 143- to 150-ft. boom and handles the corresponding 6- or 5-yd. bucket. With a 125-ft. boom, this machine can handle an 8-yd. dipper.

Electric driven draglines are favored where current costs less than 2½ cents per kilowatt hour. Experience has shown that there are less operating delays with an electric machine than with a steam and that the electric machine will dig a correspondingly greater yardage per shift. For maximum operating economy and lower power peaks, the direct current machine with field control is preferred to the alternating current type.

No important changes have been made in the design or operation of the centrifugal pumps used for hydraulic mining. Ten and 12-in. pumps are now used altogether, as

*"Gun," or monitor nozzle of the type used for stripping and mining phosphate*

the 8-in. size has been entirely discarded. A double washer with two sets of log washers and screens is required to handle the output of a 12-in. pump. The typical mine pump now used is of simple design, using one piece cast iron shells and face plates. Roller thrust bearings are now generally used in place of the older style brass washer thrust bearing and the pumps are of the single suction, unbalanced type.

Considerable thought and investigation has been given to the question of the most economical water pressure for hydraulic mining. For the average deposit of matrix (the name given to the pebbles with accompanying clay and sand), it is generally thought that a pressure of 200- to 210-lb. at the pump and 190- to 200-lb. at the "gun" (monitor nozzle) is about right, but that a variation of 150- to 225-lb. would often be desirable.

The regular hydraulic mining operation requires that the bank of matrix be first undercut until it falls and breaks up so that the phosphate can be more easily sluiced. The undercutting operation can use high pressure and low volume hydraulic water to an advantage, whereas the subsequent sluicing could use a lower pressure with a larger volume. If the above conditions could be obtained without undue complications of pit equipment, a material saving could be effected. This can be readily understood when it is explained that a 10-in. mining outfit requires 2000 bal. per minute of hydraulic water and any reduction of average pressures required will allow a saving in pumping power.

The proper size of water lines has also been investigated. It was found that with ordinary size water lines from pumping station and 10-in. lines in pit-to-gun laterals, that a large percentage of the pressure drop occurred in the smaller distribution lines to the guns, and that 8-in. spiral pipe is the desirable size for a gun connection using a 1¾-in. tip. Since the gun lines are moved very often, the weight and ease of handling is an important factor.

In the washing of the phosphate, the matter of efficient screening and recovery of the finer phosphate has been given a great deal of attention within the last year. The general trend is toward the use of vibrating screens of the Mitchell and Hummer types to replace the older shaking and revolving screens. The vibrating screens have a much higher capacity, give less trouble with blinding and do better screening. Roll crushers are used to crush up the larger lumps in order that the silica which is in the form of uncombined sand can be liberated and screened out.

One of the latest washers to be erected uses vibrating screens as shown in the following flow sheet. It is a single washer with a capacity of 14,000 tons of finished product per month of 520 hr. The usual recovery is 25 per cent of the material sent to the washed in marketable phosphate rock.

WASHER FLOW SHEET

2000 G.P.M. @ 200 lb.—10" mine pump
↓
Sloping dewatering screen with 3/64" slots
↓
Oversize — Undersize
↓ — ↓
Rotary mudball screen 1¼" round holes — Waste
↓
Undersize — Oversize
↓ — ↓
Sloping screen with 3/64" slots — Waste*
↓
Oversize — Undersize
↓ — ↓
(Note, place left for Hummer screen) — Waste*
Rotary screen with ⅜" round holes)
↓
Undersize — Oversize
↓ — ↓
Sloping screen with 3/64" slots — Roll crusher set to ⅜" Product to divider
↓
Oversize — Undersize
↓ — ↓
Divider to split flow Two Hummer screens with 1 M.M. Toncap wire screen — Waste*
↓
Oversize — Undersize
↓ — ↓
Two 18 ft. double logs in parallel — Waste*
↓
Head product — Overflow
↓ — ↓
Two Hummer screens in parallel, 1 M.M. Toncap — Waste
↓
Oversize — Undersize
↓ — ↓
Elevator — Waste*
↓
Storage bin

Note. If the nature of the deposit permits, provision is made for pumping back waste flows marked * to a reclaiming section arranged as shown below. The product of this section is of lower grade, and this is the limiting factor to the recovery by screening aside from the loss of soft phosphate in solution.

RECLAIMING SECTION

Pump
↓
Sloping dewatering screen with 1/32" slot
↓
Oversize — Undersize
↓ — ↓
Hummer screen with 1/32" opening, Toncap — Waste
↓
Oversize — Undersize
↓ — ↓
Elevator — Waste
↓
Storage bin

The unsolved problems, as stated last year, are the recovery of the soft phosphate which goes off with the clay in the solution, and the separation of phosphate and silica sand grains of the same size.

In the drying end of the operation, the increasing price of fuel oil is forcing attention to more efficient methods. A rapid general survey of the Florida field showed that the heat efficiency of the present type dryers ranges around 45 to 65 per cent, whereas 75 to 83 per cent is possible.

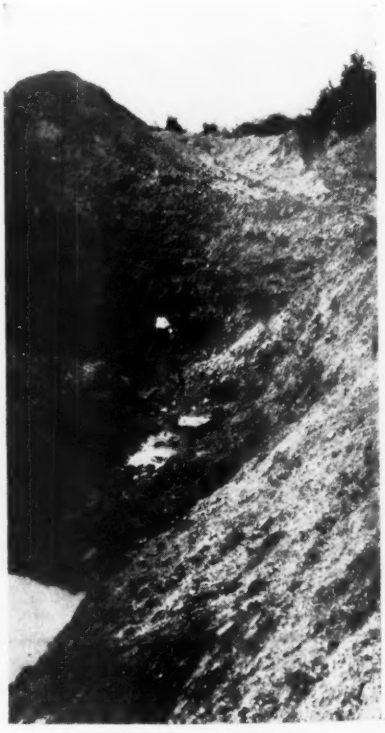
Proper draft to the dryers has been found to be very important and it is possible to effect a saving of ½ to ¾ gal. fuel oil per ton of rock in this way. Adequate drainage of the wet phosphate before feeding to the dryer is necessary, and some thought has been given to the use of centrifuges for the removal of surface moisture before the heat drying.

One company is starting a complete and thorough efficiency study of their wet storage and drying system. The aim is to secure the maximum heat efficiency together with modern mechanical design. Both mechanical and steam atomizing oil burners will be investigated. There is objection to use of steam atomization on the ground that additional moisture is introduced into the dryer. Although one large operator stated that he found little if any difference in the two types of burner.

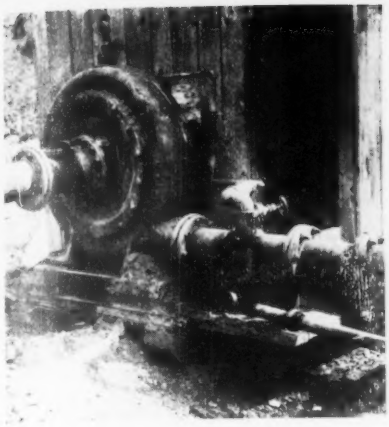
Owing to the increasing of the number of grades of rock sold and the variation in grade as mined, it is becoming common to put in large wet storage systems between the washing and drying plants. The usual arrangement consists of a trestle on which rock cars are run and dumped. The phosphate is reclaimed or stored in larger piles by locomotive cranes. A recent design, on which construction has just been started, has a capacity of 75,000 tons.

In the Tennessee field the Ridley Phosphate Co. is erecting a washing and drying plant between Mt. Pleasant and Columbia. The general flow sheet will be a log washer followed by a rinsing screen and a picking belt. The lump rock will be dried on wood in the ordinary drying kilns. The undersize from the rinsing screen will be further washed in six jet tanks and dewatered in Aikins classifiers. All of the overflows from the preceding equipment will be settled in an oblong tank. This tank when filled will be washed out and the fine phosphate sand given a final washing and dewatered in a battery of four Aikins classifiers. A common wet storage and drainage system will be served by a locomotive crane. One 66 in. by 35 ft. dryer will be installed.

The American Agricultural Chemical Corp. has remodeled its plant at Spring Hill so as to correct difficulties in feeding the washer and has added some jet washing tanks.



***Face of excavation in Tennessee brown rock deposit***



*Type of centrifugal used in hydraulic mining*

The Charleston S. S. Mining & Manufacturing Co. put its new double unit plant into operation this summer with remarkable smoothness and are now running it at full capacity.

The International Agricultural Corp. is adding a 60-ft. Dorr hydroseparator, followed by Allen washing and dewatering cones at their No. 3 plant. They are also preparing to install equipment to save fine phosphate now being wasted in the dryer flue gases by adding a 16x16x20-ft. brick dust chamber and a 5x125-ft. self supporting steel stack. The capacity of the Wales plant is being increased by additional mining equipment and a second log washer.

The Federal Chemical Co. is installing a second Dorr hydroseparator at their Ridley plant and displacing their large drag classifier with two Dorr bowl classifiers. The drag classifiers used a great deal of power, was expensive to keep up and did not wash the material enough.

No material changes in mining and handling methods have been made within the year. The increasing scarcity of hand labor has forced the companies to adopt the use of dragline excavators in the place of hand mining to a large extent. The usual machine is steam operated, mounted on caterpillars, with a 50-ft. boom and a 1¼-yd. bucket.

In the washing departments the use of jet washing tanks and Dorr classifiers for the cleaning and dewatering of the coarse sand has become common practice. For the recovery of the fine sand the Dorr hydroseparator for large volumes or Allen siphon cone for smaller flows is the accepted method of dewatering. For the final washing of the fine sand free from clay, which is a very delicate process, the tonnage is about equally divided between cones and rake classifiers of the Dorr bowl type.

In washing the lump phosphate, no standard has been fixed or approached, except it is noticeable that log washers are present in the majority of flow sheets.

In the drying end, the most successful plants operate at a high heat efficiency, running from 75 to 83 per cent.

The efficiency and capacity of the dryers is directly dependent upon an adequate wet storage and drainage system. This fact was recently proven by the Federal Chemical Co. when they doubled the output of the dryers with the same coal consumption after putting in a new storage and drainage system. The wet phosphate is handled in and out of drainage piles by a 90-ft. boom stiff leg derrick and a 2-yd. clam shell bucket. From 12 to 14 per cent of moisture that formerly had to be fed into the dryers is eliminated by drainage.

From the Rocky Mountain field it is reported that the shipment of crude lump is confined mainly to oriental exports and only very small tonnages reaching the Eastern or Middle West markets. The freight rates are the limiting factor.

The Anaconda Copper Co. has increased its mining capacity as well as the output of their phosphoric acid plant. It is shipping double superphosphate into Middle West markets, in competition with acid phosphates from Tennessee and Florida phosphates.

# The Sand-Lime Brick Industry

By William H. Crume
President, The Crume Brick Co., Dayton, Ohio

THE PAST YEAR has been a prosperous year for most of the sand-lime brick manufacturers with whom I have been in touch, and I am very pleased to say that so many existing plants are increasing their capacity and installing the most modern type of equipment. Quite a number of plants are installing automatic proportioning machines for measuring sand and lime in connection with rod mills for grinding and mixing of their raw materials. This means not only a greatly improved product, but elimination of quite a lot of manual labor, also cheaper cost of production.

Sand-lime brick are today more of a factor in building construction than at any time since their introduction twenty-two years ago. While the plants are comparatively few compared to the manufacturers of common clay brick, in the market where the sand-lime brick are in competition they are gaining ground rapidly.

W. H. Crume

Detroit, with four plants in operation, with one-half dozen other plants within a hundred miles or so, has become quite a sand-lime brick market. The plants in Toronto and Winnipeg, Canada, are furnishing their share of common brick, used in those markets. During the past year many millions of sand-lime brick have been used in New York City and vicinity. Part of the brick have been manufactured in several plants near the city, and a number of million have been imported from Germany.

It has been stated on good authority that the sand-lime brick imported into New York City market prevented the clay brick manufacturers from sky-rocketing their prices, as the demand for brick for a number of months was far greater than the supply.

Reports I have received from other parts of the country from sand-lime brick plants in operation are that the plants are enjoying a prosperous season, and that the outlook for their particular product is better than at any previous year.

Several new plants are under construction, and I look for a steady gain in the production of sand-lime brick for some years to come.

## Receiver Appointed for Cement Company

FEDERAL Judge Knox of New York City has appointed Martin Conboy receiver in equity for the Hudson Valley Portland Cement Company under bond of $25,000, according to the New York Times.

The petition for receiver was filed by the J. P. Burton Coal Company. It said the Hudson Valley company has 500 acres of land and a plant at Alsen, N. Y., valued at $2,000,000.

# Concrete Brick Progress in 1923

## Three Big-City Plants Financed by Substantial Business Men Are Endorsement of Concrete Brick

THE outstanding development in the concrete-products industry during 1923 was the endorsement of Shope concrete brick implied by the adoption of the Shope process by large and substantial interests in Baltimore, Atlanta and Los Angeles. In each case business men long and prominently identified with the sand and gravel industry have gone into the manufacture of concrete brick, more particularly face brick, on a scale comparable to many clay-brick enterprises.

As was to be expected, when the real worth of concrete face brick is recognized, a lot of controversy and competition are the results. The Shope Brick Co. is meeting with infringers on its processes and manufacturers of Shope brick are meeting with competition in all of its worst phases from the manufacturers of clay brick.

Clay brick manufacturers have in many instances, stooped to knocking campaigns, which will ultimately certainly do them a lot of harm, just as every knocker eventually hurts himself more than anyone else. For example the people of Portland, Ore., have a building show every year. At the 1923 show the clay brick interests had a fairly attractive exhibit, but it was disfigured by a large sign stating: "If it isn't burned it isn't a brick." A few feet away was the Shope concrete face brick exhibit illustrated herewith. Visitors naturally looked on the clay-brick exhibit and sign as a huge joke.

In Baltimore where the Arundel Shope Brick Co. (affiliated with the Arundel Sand and Gravel Corp.) is doing an immense business in concrete brick, a controversy was recently started through the local public school board over the allegation that concrete brick had been substituted for clay brick and were inferior to clay brick, and that their use would endanger the lives of the pupils who would attend the school.

The mayor of Baltimore appointed an investigating committee comprising the city comptroller, a nationally known architect and a nationally known consulting engineer, among others. As often happens in such instances the agitation had just the opposite effect from that designed by its instigators. The committee reported the concrete brick "entirely satisfactory." Among other things in the report were the following endorsement of concrete brick and of the particular brick used:

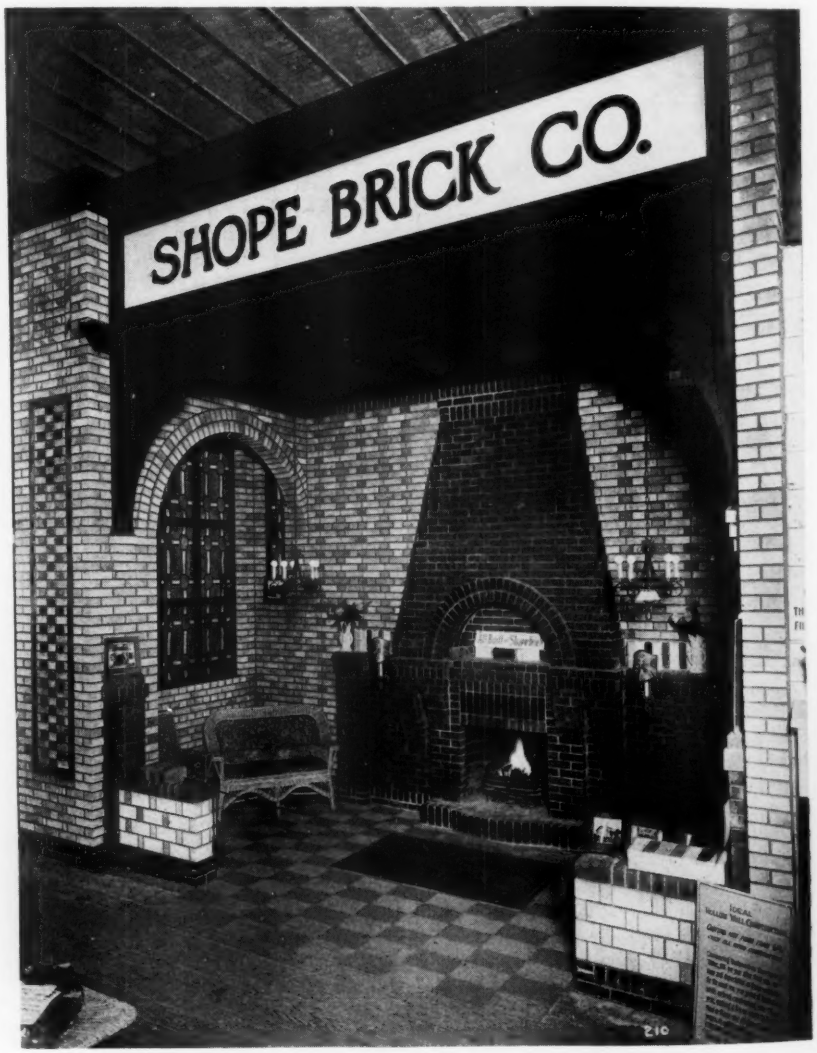
"The bricks are amply strong to meet all requirements to which they are being put. The strength of the concrete increases steadily with age.

"Concrete in various forms is probably the most used material in modern building construction, and it should be as satisfactory in the form of bricks as in many other forms."

The Shope Brick Co., of Portland, Ore., has also had to fight the competition of infringers of their patent rights to processes and machinery. Several United States district court decrees have been given in favor of the Shope Brick Co., and cases involving permanent injunctions against infringers are now pending in the courts of Portland and Philadelphia.

The first of these decrees was issued by the United States district court in and for the district of Arizona on May 16, 1923. The decree was that the infringers "be and they are hereby enjoined and restrained from making or manufacturing their said brick machine described in the bill of complaint herein, or any other similar brick machine which may infringe on the said patents and patent rights of the plaintiffs and from further making or manufacturing any of such brick or any similar brick which infringe upon the patents and patent rights of the plaintiffs, as herein set forth, and from, in any way representing that any such brick, so made and manufactured by the said defendants, are the same bricks or as good as or better than the bricks made by the said plaintiffs under their said patents and patent rights."

The Shope Brick Co. intends to fight infringers wherever found. D. F. Shope, president of the company is actively engaged in promoting the use of concrete brick and it is probable that in the near future a national association of concrete brick manufacturers will be organized to meet with organized clay brick competition on equal terms.




***Shope concrete brick exhibit at Portland, Ore., building show***

# Silica Sand Plant of Newest Type

## Plant of the Everhard Company at Massillon, Ohio, Has Tower Dryer and Unusual Crushing and Screening System and Is of Excellent Design and Construction

THE new Everhard plant at Massillon, Ohio, which is expected to begin production in January, exemplifies the latest practice in the preparation and drying of crushed silica sand rock. There is no washing because the slight amount of impurities which are present are of equal value with the silica in giving refractory qualities to the sand, all of which is used either for making furnace bottoms or as steel molding sand. The reputation of the product is so well established that shipments have been made to all parts of the United States.

The outstanding features of the new plant are the use of the tower type of dryer and the solid and substantial construction, in which brick and concrete have been used in an unusual amount. The design was made by the Kennedy-Van Saun Co. of New York which also supplied the machinery, including crushers, rolls, shaking screens, the tower dryer and the dust-collecting system.

The quarry is an old one which was worked for bridge stone and grindstones by the father of the present owner. The grindstones had a great reputation throughout the United States and Canada, but their production alone was not enough to keep the quarry busy and, after concrete superseded cut stone for railroad bridges, the quarry was changed to silica sand production. As quarried, the material runs about 97 per cent $SiO_2$.

*The No. 7½ crusher above and the No. 37 below*

There are two ledges which are each about 30 ft. thick so that the quarry face averages 60 ft. in height. They are mined separately and mixed before being sent to the plant in the proportions which experience has shown will give the refractory qualities needed for the particular purpose for which the sand is intended. This mixing is something of a secret and all the silica sand plants in this district have their own methods of selecting and mixing rock to obtain the desired refractory qualities.

All of the rock makes excellent steel molding sand and the dust is in great demand with the building trade for making "Caen Stone" and other forms of ornamental plaster.

The rock comes from the upper ledge by means of cars which run across a trestle on a level track. From the lower ledge the cars are hoisted up an inclined track and both dump into a 20-ft. square and 20-ft. deep steel bin. All the rock goes from the bin through a No. 7½ crusher and then over a pulsating grizzly set with ¾-in. spaces. The oversize of the grizzly goes to a No. 37 crusher and joins the undersize in the boot of a No. 6 mill type elevator.

Both crushers are K-Van S. gearless

*Everhard Co.'s silica sand plant ready for covering in. The small bin at left of tower dryer is the equalizer bin*

*The upper and lower beds are quarried separately and mixed as desired for crushing and drying*

gyratory machines and the grizzly is of the same make. Note that there is no return or rescreening of either crusher product, as nothing passing the No. 37 is too coarse to be taken care of by the rolls which crush it after drying.

In any drying operation the rate of feeding the material to the dryer is the most important part. The moisture in the stone varies with the weather and the length of time it has been exposed and, if a constant moisture content is to be maintained in the finished product, the rate of feeding must correspond to the moisture present in the undried stone. In this plant the rate is maintained by an equalizing bin which will hold half a day's run and a plunger feeder which can be set to govern the rate of feed to the dryers within the limits needed. This type of bin and feeder has been found successful in other plants erected by the Kennedy-Van Saun Co. The equalizing bin is filled from the elevator which follows the crushers and a second elevator takes it from the feeder to the top of the tower dryer.

The decision to use a tower dryer in the new plant was logically made. The old plant of this company had a small 3x3-ft. dryer of the tower type, which made a remarkably good record, as it dried considerably more than its rated capacity. This old dryer lacked the refinements and the improvements which have been introduced by the Kennedy-Van Saun Co. in its patented form, so it is certain that the new dryer should give at least three times the capacity of the old, and this would be enough for a satisfactory output.

The dryer is 6x6 ft. and 50 ft. high. It contains 29 sets of cast-iron baffles of T section which are 4 in. wide on top and set at 8-in. centers. Alternate sets of baffles are crossed and the baffles are staggered so that the sand has to fall from one to the other in a zig-zag path. The effect is to open out the sand so that each grain may come in contact with the heated air and gasses which rise through the stack and also to so delay the passage of the sand through the stack so as to give it time to dry.

A ridge of sand forms on top of each baffle. This receives the fall of the sand and hence prevents any wear on the baffle itself. [The October 6 issue of Rock Products gives a description of this dryer as applied to drying crushed limestone.]

The stack is built of hard burned brick which the Everhard Co. made in its own brickyards near the plant.

A point of special interest in this dryer is the design of the firebox. This has an unusually large combustion chamber the top of which is 7½ ft. above the grates. It has been found that with this combustion chamber the free carbon is all consumed, if the coal is properly fired, before the gasses enter the stack, so that the sand is not discolored by smoke even when soft coal is used.

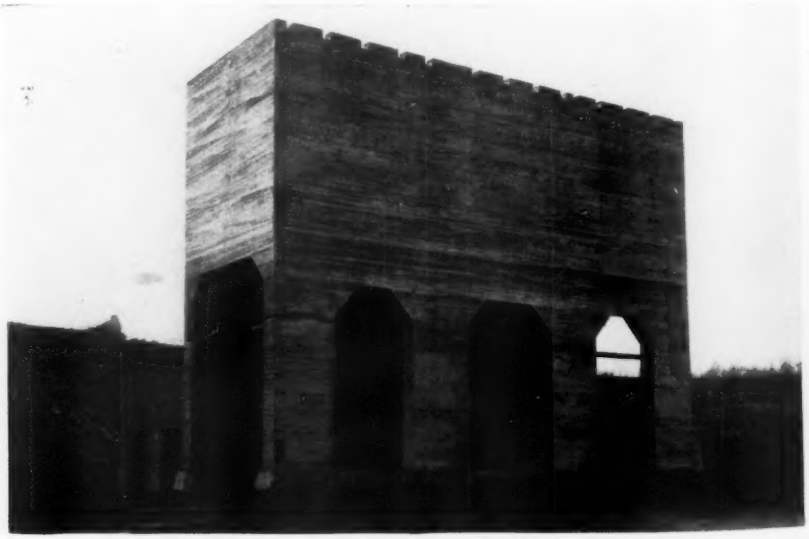
Near the dryer is a room of brick in which the Bury air compressor is housed. Another room alongside contains the switches and starting boxes for the plant.

The hot elevator which receives the dried sand is in a steel casing, all the other elevators being incased. This elevator, the top of the dryer stack, and the pulsating screen are connected with the dust-collecting system, consisting of two fans and two cyclones. The collected dust falls from the cyclones into the dust bin, and as the drying, elevating, and screening produce more dust than any other parts of the process it is expected that the plant will be practically free from dust.

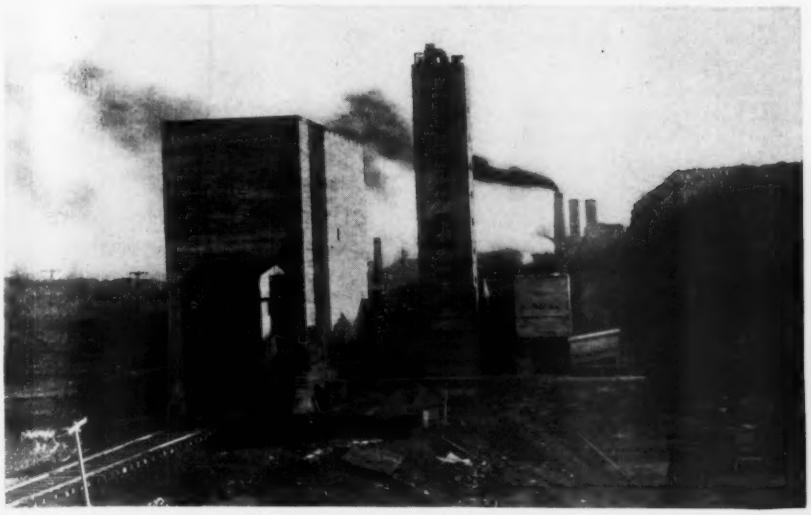
The advantage of the tower dryer is the freedom from wear. There are no moving parts except those connected with the elevators, so ordinary elevator repairs are all that will have to be made.

It is expected that the sand will reach a temperature of 350 deg. F. in passing through the dryer.

The dried sand goes to a pulsating screen which is covered with 2-mesh, 5-mesh, or 8-mesh wire cloth, according to the material that is to be made. Furnace material is that which passes a 2-mesh screen. Steel molding sand is made with either a 5-mesh or an 8-mesh screen, depending upon the size of castings for which it is to be used. The oversize of whatever screen is used goes down a chute to a pair of 24x12-in. heavy duty



*The bins are very substantially built of reinforced concrete*

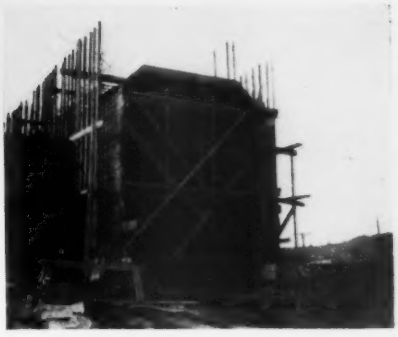


*View showing relative positions of loading bin, tower dryer and equalizer bin*

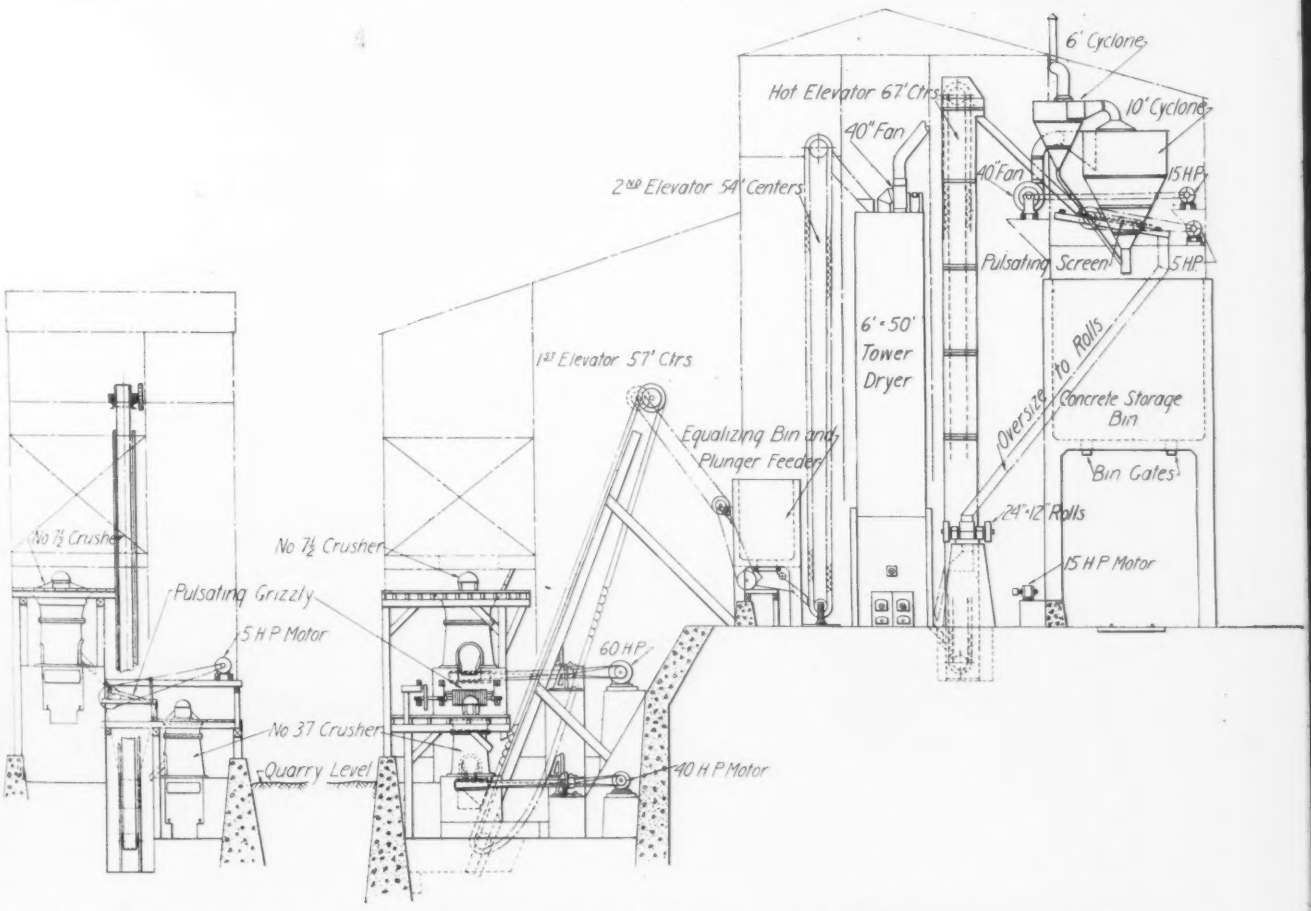
crushing rolls and from these to the boot of the hot elevator which serves in this way as a return elevator as well as for lifting the dried sand.

The undersize of the screen goes to one of three bins. A fourth bin holds the dust. These bins are very solidly constructed of reinforced concrete and are upheld by reinforced concrete walls. One of the pictures reproduced here shows the forms in being placed for pouring the lower part of the bins. There is the full 21-ft. clearance required in Ohio from the top of the rail to the bottom of the bins. They are 29 feet deep, all live storage.

All of the plant is splendidly built. The views of the foundations show how massive these are, insuring not only permanence but steady running of the various machines and a small repair bill. The whole plant sets on a raft type foundation of concrete, the slab being 6 ft. thick under the crushers and the heavier machines. This foundation concrete was mixed 1:3:5 and the concrete for bases 1:3:4. All the concrete is heavily reinforced with 1-in. and ¾-in. rods from the



*Forms being set to pour concrete for the loading bins*




*Left: End section. Right: A section giving the complete flow sheet from the primary crusher to the loading bins*

Peerless Drawn Steel Co.'s plant at Massillon.

The building is of structural steel and contains about $25,000 worth of structural shapes which was furnished by the Massillon Bridge Co. The steel will be covered with Robertson's Protected Metal, a corrugated metal sheeting which is covered with three coats of a rust-proof composition which is said to resist the effects of weather almost indefinitely.

All the machinery in the plant is of Kennedy-Van Saun make and design, except the air compressor mentioned and a hoist made by the National Hoisting Engine Co. In the quarry work there are two Thew shovels and a well drill of the Everhard Co.'s own design and make. Hardscog Wonder jackhammer drills are used for secondary drilling.

This mill is all electrically driven, individual motors made by the General Electric Co. being used. The combined horsepower is about 250.

Charles B. Scott, of the Kennedy-Van Saun Mfg. and Eng. Corp., is in charge of construction.

M. McC. Everhard is president and general manager of the company, and it is to his experience and ideas that the details of the plant are largely due. H. T. Yost, secretary and treasurer, has also been with the company for a good many years.

# Big Convention of Agstone Producers Coming

A RECENT bulletin of the National Agstone Association announces.

"For the first time in the history of the National Agstone Association two days will be devoted to the annual meeting. The program will be divided into five sessions as follows:

Tuesday, January 15, 1924.

First session—10 A. M.
Luncheon—12:30 P. M.
Afternoon session—2:00 P. M.
Adjournment—4:30 P. M.
Annual dinner—6:00 P. M.

Wednesday, January 16, 1924.

9:00 A. M.
Lunceon—12 Noon.
Afternoon session—1:30 P. M.
Adjournment.

"Plenty of time will be given for round table discussion which will give opportunity to all to relate their experience, success, failure, troubles and problems of the Agstone industry. General belief exists that the practical part of the game should have as much attention as the theoretical.

### *Associate Members*

"Agstone producers appreciate the helping hand of the following associate members of this Association: Jeffrey Manufacturing Co., Columbus, Ohio; Marion Steam Shovel Co., Marion, Ohio; Bemis Bros. Bag Co., Peoria, Ill.; The Jaite Company, Jaite, Ohio; George & Sharrard Paper Co., Wellsburg, W. Va.; The Adams Bag Company, Chagrin Falls, Ohio. Representatives of these associate members are expected to attend the annual meeting.

### *The Ladies*

"Ladies will accompany some of the members. The ladies will be welcome. Provision will be made for their entertainment. Pittsburgh has the most famous shopping show windows in the world. The ladies are invited to attend the evening dinner session which will be informal.

"Every agstone producer (and associate member) is requested to do missionary work and urge non-member agstone producers to attend this annual meeting. Invite those who have large and modest production. Members are privileged to invite county agents or friends to the first day's session and annual dinner, providing they pay for the extra tickets used."

The secretary was advised to make up annual program and to invite the following persons to attend and participate:

Messrs. Broughton and Vandervort, and Professors Bear and Salter, and Dean Vivian of Ohio State University.

Dr. Thomas, Prof. White and Prof. Watts, State College, Penna.

Secretary Wallace, or his representative of U. S. Department of Agriculture.

The Secretary of Agriculture, Mr. Willits, of Pennsylvania.

The Director of Agriculture, Mr. Truax, of Ohio.

Dr. Thorne and Dr. Williams of Ohio Experiment Station, Wooster.

Prof. Gustafson, Cornell University, Ithaca, N. Y.

The editors of the following trade journals and farm press: *Rock Products, Pit and Quarry, Cement Mill and Quarry, National Stockman and Farmer, Ohio Farmer, Pennsylvania Farmer, Michigan Farmer, Breeders Gazette, Country Gentleman, American Agriculturist, Rural New Yorker, Prairie Farmer, Farmers Guide, Farm and Dairy.*

J. W. Kellogg, Chief Chemist, Harrisburg, Pa.

Septimus Mawer, Chief of Fertilizer Dept., Columbus, Ohio.

R. A. Hayne, International Harvester Co., Chicago.

Dr. A. G. McCall, Chief of Soils Dept., College Park, Md.

L. J. Taber, Master National Grange.

Harry A. Caton, Master Ohio State Grange.

L. B. Palmer, President Ohio Farm Bureau Federation.

James McSparran, Master, Pennsylvania State Grange.

## Walter F. Jahncke Honored

WALTER F. JAHNCKE, of Jahncke Service, Inc., New Orleans, La., sand and gravel producers and building supply dealers, has been elected president of the Southeastern Builders' Supply Association. The annual convention of the association held in New Orleans, December 3, 4 and 5, was attended by over 200 representative dealers and manufacturers, according to the *Building Supply News*, which states:

"In installing President Jahncke, retiring President Baker said: 'I have never seen him falter in his duty to the association; he has sacrificed himself repeatedly, and has attended meetings of the board of directors splendidly. The people of New Orleans know when Walter Jahncke puts his hand to the plow that work is going to be done. I predict that 1924 will be the brightest and most successful year in the association's history.'

***Walter F. Jahncke***

"In accepting the office and the honor that went with it Mr. Jahncke was deeply affected and stated his appreciation and pledged his best efforts to the organization, pleading at the same time for the co-operation of the membership, saying in part: 'I, or the secretary, cannot do a thing unless we get your co-operation. We want the manufacturers to know we are anxious to play fair with them and that we desire their continued co-operation."

# The Modern Sand-Lime Brick Plant

## Grande Brick Company, Grand Rapids, Mich., Is Typical of Modern Tendency in Sand-Lime Brick Plant Construction and Operation

By Charles A. Breskin

THE manufacture of sand-lime brick has undergone a great many changes and many improvements have been made in the manufacture of this product during the last 10 years. Most of the changes were due to shortage of labor, the ever increasing cost of fuel and other elements that enter into its manufacture. On the other hand some changes were made voluntarily in order to improve the quality of sand-lime brick, as well as to reduce the cost. The most notable of these are the methods of hydrating lime and the mixing of the sand and lime before it goes to the presses.

It isn't so very far back that the universal method for mixing sand and lime was by the old-fashioned pug mill. Proportioning was done by hand and plenty of labor was required. The wet pan then succeeded the pug mill and this was, indeed, a notable improvement, as it eliminated considerable labor, improved the quality of the brick and cut manufacturing costs. Then the rod mill made its appearance and around this highly successful device is built the modern sand-lime brick plant.

The Grande Brick Co. is located in Grand Rapids, Mich., and is typical of a sand-lime brick plant that has succeeded in the face of strong clay brick competition. The plant was built in 1909. At that time lime was hydrated in quenchers and was put in a hardening cylinder to finish hydration while the brick were being cured. Lime and sand were proportioned by shovelfulls, the ratio being five shovels of sand to one of lime. The mixture was then delivered to a double-screw mixer, where water was added. The factory had one 12-mold rotary press and three hardening cylinders. The output was 26,000 bricks per day and 39,000 when operating overtime so as to fill the hardening cylinders to capacity.

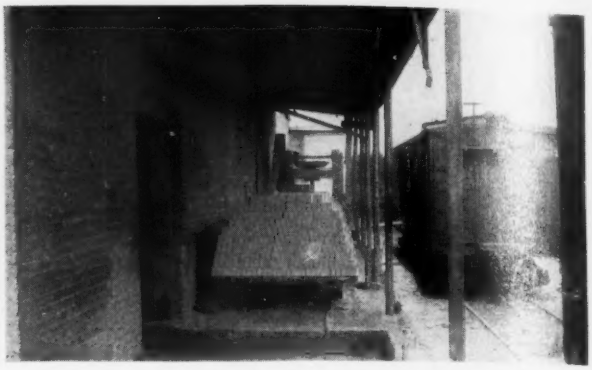
It was in 1922 that the Grande Brick Co.'s plant was transformed into one of the most modern sand-lime brick plants in the country. The sand pit is about 500 ft. from the factory. The sand is rather fine and occurs in small hills or dunes. It is excavated by a ¼-yd. dragline scraper, which works through a radius of 500 ft. This discharges onto a short belt conveyor, which, in turn, discharges over a stationary piano wire screen, where the coarse material is removed and the fines go to the main conveyor belt. The main conveyor is 14 in. wide, 180 ft. centers and is set on a straight line to the short conveyor.

The piano wire screen is between the two belts.

At a point 28 ft. above ground level the main conveyor discharges to a third belt conveyor, 14 in. wide, 30 ft. centers, and at right angles to the main conveyor. This conveyor discharges normally to a 40-ton sand-hopper, but it is equipped with a reversing device so that in case the sand comes in faster than it is required by the

*Plant of Grande Brick Co., Grand Rapids, Michigan. Trucks for city trade are loaded from storage in rear of plant*

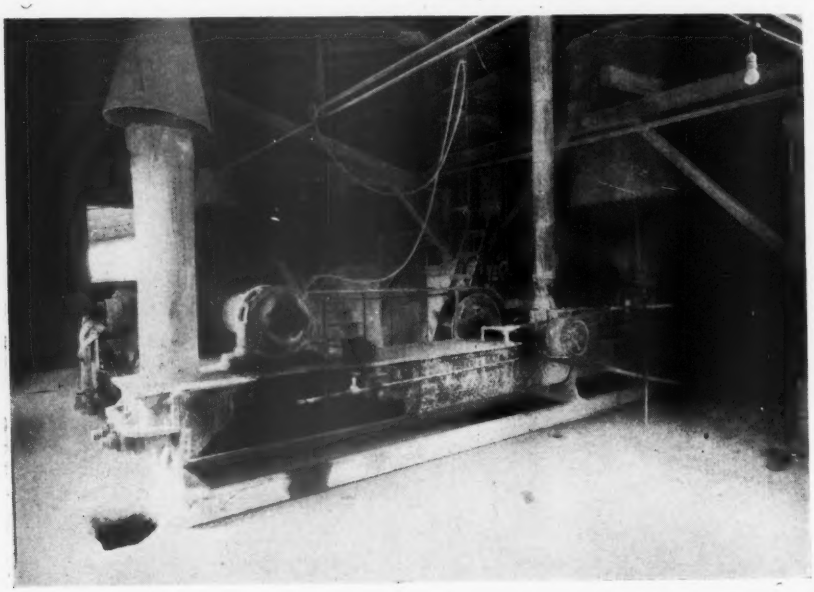
*Main belt conveyor delivering sand from pit into storage located in brick factory*



*Unloading track for bulk lime. Also serves as loading track for brick. Note lime pot crusher in background*

plant, it can be diverted to an auxiliary sand storage of 300 tons capacity, under the same roof. It is reclaimed from here by a bucket elevator, of 30 ft. centers, discharging into the sand hopper.

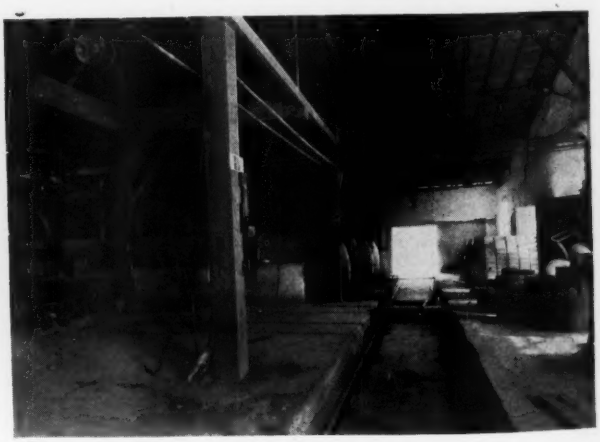
The lime is received in the factory in box cars. It is unloaded on to a portable belt conveyor, discharging into a Jackson lime pot crusher, fitted with an overhead bevel gear drive. Only one man is required for this operation. The discharge from the crusher goes to an 8-in. screw conveyor set in a 5x5-ft. tunnel under the factory. The screw conveyor delivers the crushed lime to a bucket elevator of 54 ft. centers, which discharges to a 6-ton lime hopper set directly above a Jackson hydrator of the double shaft pug mill type.



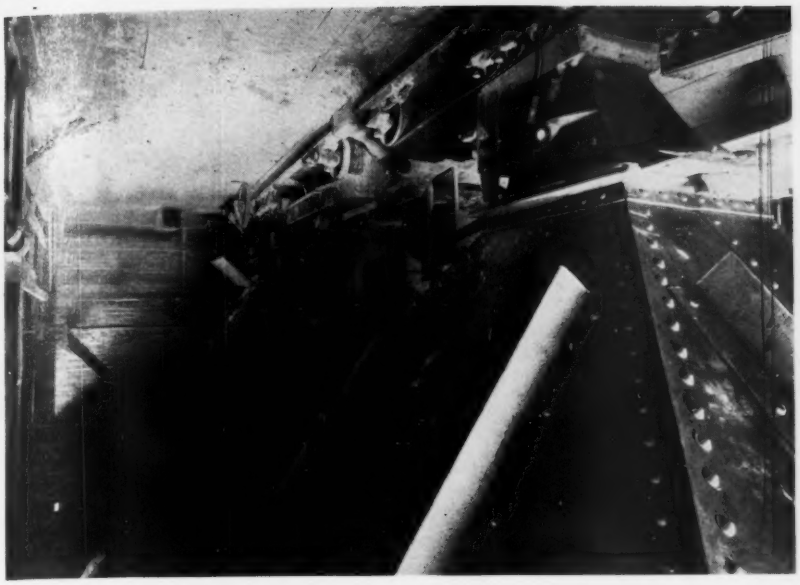
*The lime hydrator is pivoted at the feed end, while the discharge end is free to travel, discharging to any one of three silos*

The lime is taken out of the hopper by an automatic feeding device and discharged into the hydrator. Here it is sprayed with a suitable amount of water, thoroughly mixed and conveyed to the opposite end of the hydrator. By this time the hydration is nearly complete and the lime is discharged to any one of three silos. The hydrator is pivoted at the feed end, while the discharge end is free and runs on a track, thus discharging to any silo. The three silos have a combined capacity of 160 tons. An auxiliary lime storage of 60 tons capacity is provided for emergency cases, such as car shortages, etc. The lime in the silos is allowed to season thoroughly, for much of the success in sand-lime brick manufacture depends upon

*The rotary brick presses with feed hoppers in background. Two turntables are located in front of each press. The transfer track leads to hardening cylinders*



*Transfer car to hardening cylinders. There are four cylinders, 6 ft. 6 in. in diameter by 56 ft. long. Each cylinder holds 15,275 brick*



*The Volumeters accurately proportion lime and sand. The discharge is to a common hopper feeding the rod mill*

how thoroughly the lime has been hydrated.

Each silo has a side discharge at the bottom going to an 8-in. screw conveyor directly under the floor level of the factory. The screw conveyor is both right and left hand, the discharge being at a common point. Here the lime is received by a bucket elevator of 32 ft. centers, discharging to a 12-ton bin overhead the Church Volumeters. The lime bin is adjacent to the sand bin, which is also set overhead a Volumeter.

The Volumeters, shown in one of the accompanying illustrations, are automatic measuring devices that proportion the sand and lime into one common hopper, by volume rather than by weight. The device can be regulated so as to take care of moisture content in sand, etc., and will measure exactly within a small per cent of error. It is connected electrically with hammering devices that will loosen the material should it become bridged in the hoppers and thereby keeping the correct amount of material on the belts. The hoppers overhead the Volumeters are constructed of steel plate and have mechanical agitators inside so as to facilitate easy discharge of the material.

The sand and lime in proper proportions go from the common discharge hopper to a short belt conveyor, 12 ft. centers, which delivers to the rod mill. The installation of the belt conveyor was necessary because in reconstructing the factory there was not sufficient space to put the rod mill directly under the volumeters, as was intended.

The rod mill is 4x10 ft. and of exceptionally rugged construction. It is lined throughout with a special alloy steel and is loaded with five tons of 10-ft. long rods, ranging from 2 to 4½ in. in diameter. The mill is run by a 50-hp. motor at 14½ r.p.m. and has an inclination of 1 in. to the foot. It easily prepares sufficient mixture for 60,000 brick in a 10-hour day.

The discharge from the rod mill goes to a short belt conveyor, 20 in. wide, the head end of which is fitted with a Dings magnetic pulley, which removes any stray iron that may be in the material. The belt conveyor delivers to a bucket elevator of 26 ft. centers and the discharge is regulated to either or both of two material hoppers ahead of two 12-mold Jackson & Church Co. rotary presses. These presses have a capacity of 30,000 brick per 10-hour day. One of the presses has been in continuous operation since 1909.

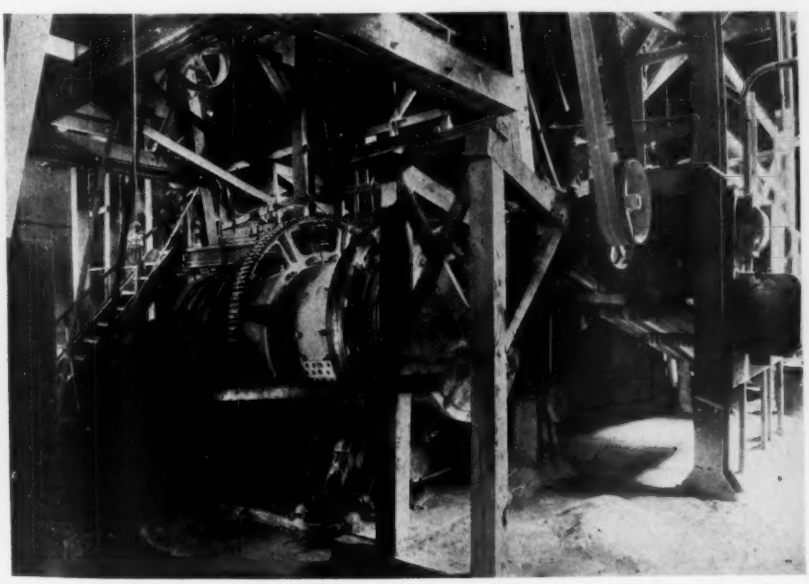
The brick, as they come from the presses,

*To the left, H. O. Joseph, secretary and general manager of Grande Brick Co. Right, J. Morely Zander, assistant to the president*

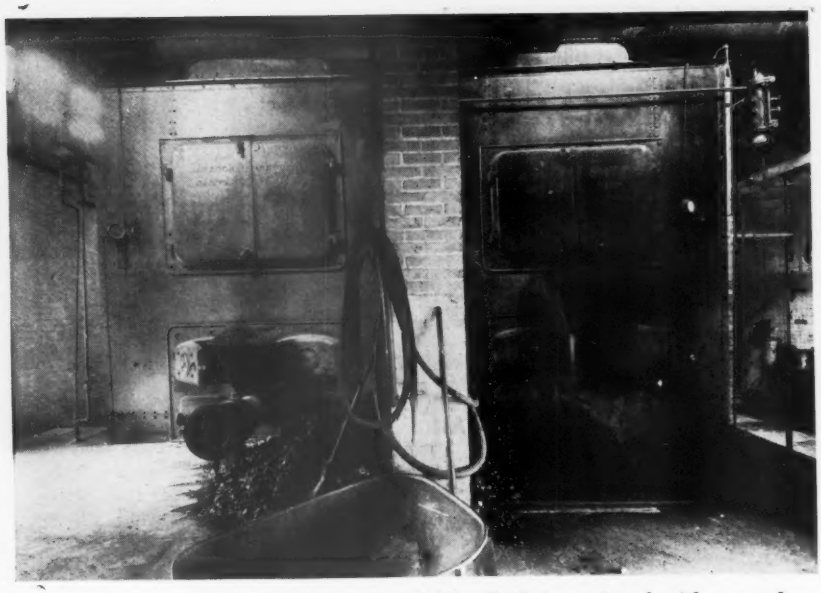
are piled onto steel flat cars, holding 1175 brick each. The cars are then transferred to the hardening cylinders, where they await curing. There are four hardening cylinders, 6 ft. 6 in. in diameter by 56 ft. in length. The brick are cured for 10 hours under 125 lb. steam pressure. After curing the brick are transferred to storage or into box cars and trucks for shipment.

The plant has a capacity of 60,000 brick per 10-hour day and only 22 men are required to operate the entire plant. It was engineered by Jackson & Church Co., of Saginaw, Mich. This company also manufactured the hydrator, lime crusher, Volumeters, rotary presses, transfer cars, kettles and other interlocking machinery. The plant is served by the Pere Marquette Railroad.

Steam for curing is generated in two 72-in. by 18-ft. Jackson & Church Co. return



*The rod mill is 4x10 ft. and is charged with five tons of rods ranging from 2 to 4½ in. in diameter. It is driven by a 50-hp. motor*



*Two boilers generate steam for curing brick. Each is equipped with an underfeed type of automatic stoker*

tubular boilers, equipped with Jones underfed stokers. Only one boiler at a time is fired. The plant is electrically operated throughout, the motors and machines being as follows:

| Machine | H.P. Motor |
|---|---|
| Rod Mill | 50 |
| Sand Volumeter | 2 |
| Lime Volumeter | 2 |
| Belt Conveyor (Volumeter) | 2 |
| Belt Conveyors (Sand) | 13 |
| Lime Elevator | 5 |
| Lime Screw Conveyor | 3 |
| Raw Lime Elevator | 5 |
| Hydrator | 10 |
| Lime Crusher | 15 |
| Brick Presses | 25 |
| Water Pump | 2 |
| Dragline Scraper | 10 |

The president of the Grande Brick Co. is John L. Jackson. He has been associated with the sand-lime brick industry for a great many years and was one of the organizers of the sand-lime brick association. Chas. W. Garfield is vice-president. H. O. Joseph, secretary and general manager. Mr. Joseph has been on the job since 1909. J. Morely Zander is assistant to the president and active in the management of the plant. He is the president of the sand-lime brick association.

## Big Four Stone Company Sells Plant to State

THE Big Four Stone Co. has sold its plant at Ingalls, Ind., to the state of Indiana. It is to be operated in connection with the new reformatory at Pendleton.

## A. Acton Hall Dies

THE AMERICAN quarry industry has lost one of its leaders by the death, on December 26, of A. Acton Hall, president of the Ohio Marble Co., Piqua, Ohio. Mr. Hall was so well known and so beloved by a multitude of friends in the quarry industry that any appreciation of his life and work that we might attempt would be feeble indeed.

Probably no man ever studied the possibilities of plain ordinary limestone, or developed so many and so diverse products of ordinary raw limestone, or had such a vision of the possibilities of limestone, as A. Acton Hall. It is little short of marvelous that ordinary crushed stone should be made into packages and sold all over the United States and even exports made of it, yet these things Mr. Hall did through his remarkable business acumen, and vision, and his knowledge of and his faith.

*A. Acton Hall*

He was born in Cincinnati about 63 years ago, the younger son of Joseph Lloyd Hall, founder and president of the famous Hall Safe and Lock Co. His early business experience was with his father's company, but later, leaving the safe business to his elder brothers, he branched out into what was then considered the least desirable business in the world for a man of his character, training and experience—the operation of a quarry—the Ohio Marble Co.

A. Acton Hall was a strong, forceful, intelligent, kind-hearted and fair-minded man, who has left his mark in the history of the American quarry industry as few other men can possibly do. He was always one of the prime movers of the Ohio Macadam Association and the National Crushed Stone Association, and his loss to the quarry industry will be keenly felt; his helpful, cheerful, decisive counsel will be sorely missed.

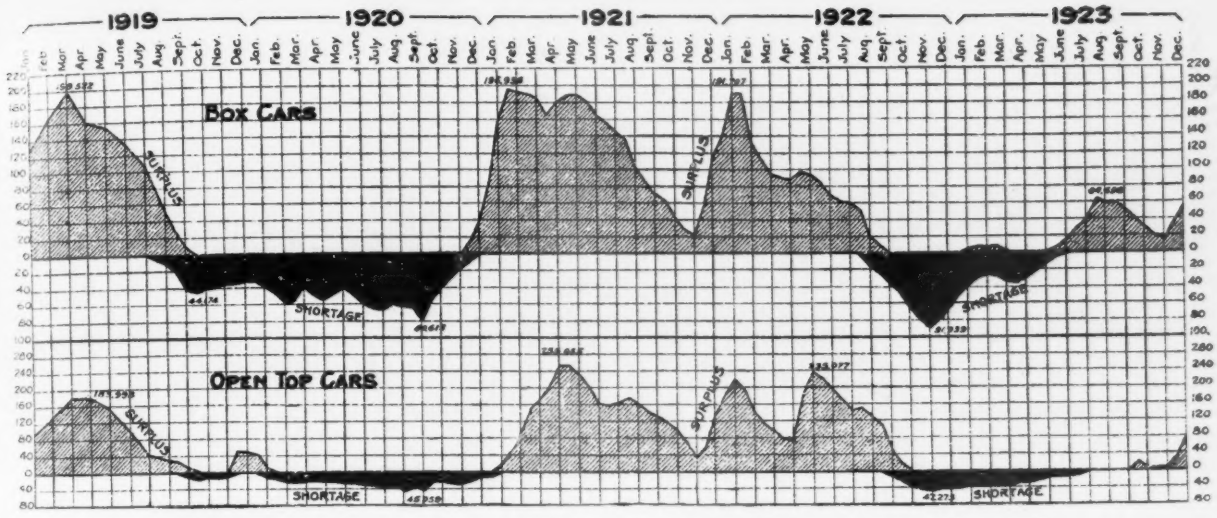
## Railway Loadings

A STUDY of the graphs on the opposite page will prove interesting to every rock products shipper. The first of these is taken from a recent bulletin of the American Railway Association and shows the fluctuations in the use of box cars and open-top cars during the whole period since the war. It is one of the best indexes of prosperity and depression available; but it also shows the very seasonal character of the railway business. It shows that business got an unusually early start in 1923 and was more than ordinarily uniform throughout the year. Undoubtedly this was an exceedingly healthful factor.

The second graph showing the carloads of sand, gravel and stone shipped during 1923 is also interesting as being the best check we have on the production of these commodities. The total of 2,000,000 cars is equivalent to from 60,000,000 to 75,000,000 tons—as a very conservative estimate. This curve was platted by the editors from data furnished by the car service division of the American Railway Association at Washington. The manager of the open-top car division is W. J. McGarry.

From figures collected by Rock Products from producers some two years ago we estimate that about as much sand and gravel is moved by barges or scows from production point on the rivers and harbors adjacent to big cities, as is moved by rail. Considering two-thirds of the above figure as sand and gravel (40,000,000 to 50,000,000 tons), the amount moved by both rail and water is 80,000,000 to 100,000,000 tons.

Of the amount moved by motor truck,

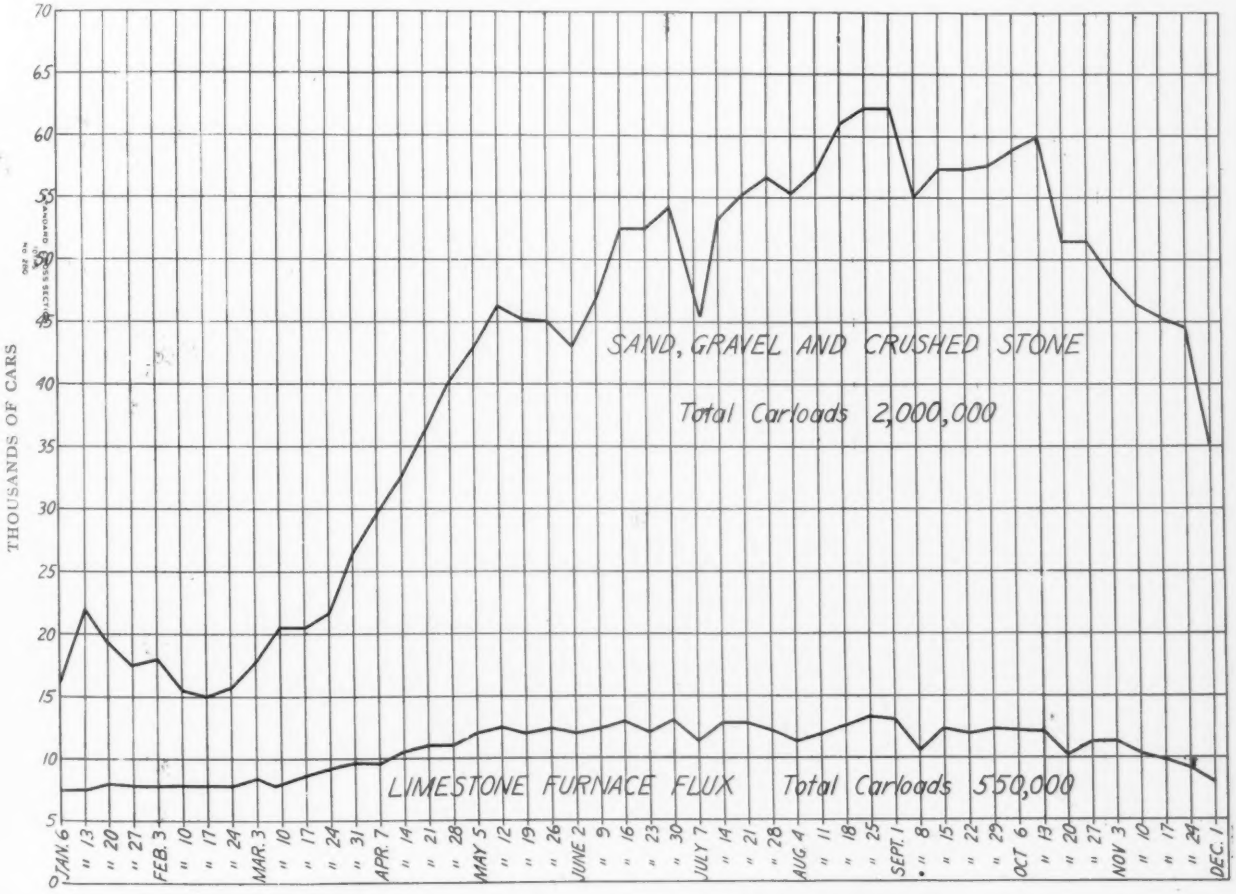



***Railway car supply, 1919 to 1923, inclusive, showing fluctuations of supply and demand***

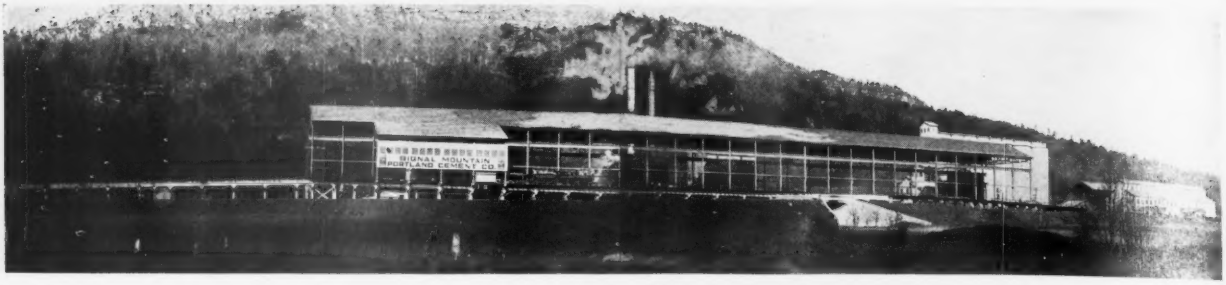
any kind of an estimate is indefinite. Probably, however, under present freight rates, fully as much or more sand, gravel and stone moves from production point to job in motor trucks as by rail. If we accept this assumption the total annual production of commercial sand and gravel must be in the neighborhood of 150,000,000 tons.

The water movement of fluxing limestone on the Great Lakes is in the neighborhood of 10,000,000 tons a year. Adding this to the 25,000,000 tons moved by rail, and we have 35,000,000 tons of crushed limestone; if one-third of the 2,000,000 cars of sand, gravel and stone was crushed stone we have practically another 25,000,000 tons; or in other words, the total annual production of crushed stone is the neighborhood of 60,000,000 tons, not including railway ballast, which in normal years prior to the war accounted for one-third of the annual production. Including railway ballast, the total is 100,000,000 tons.

To summarize, the sand and gravel pits and quarries of this country produce 250,000,000 tons of material annually, valued as a raw material at $250,000,000.




***Carloadings of crushed stone, sand and gravel by weeks during 1923***



*Panoramic view of the newly completed Signal Mountain plant*

# Signal Mountain Plant Completed

## This New Cement Company's Wet-Process Plant at Chattanooga Is a Model of Simplicity, Designed for Future Installation of Three Additional Units, Increasing Its Capacity from 2500 to 10,000 Barrels

By George M. Earnshaw

THE first unit of the Signal Mountain Portland Cement Co.'s plant at Chattanooga has been completed. The first of the two kilns comprising this unit was fired on October 12 and at the time of the writer's visit, November 30, operating officials expected to have the second kiln fired and producing clinker during the week of December 2. At that time, the company had in storage clinker estimated at from 40,000 to 45,000 bbl. This was produced by one kiln.

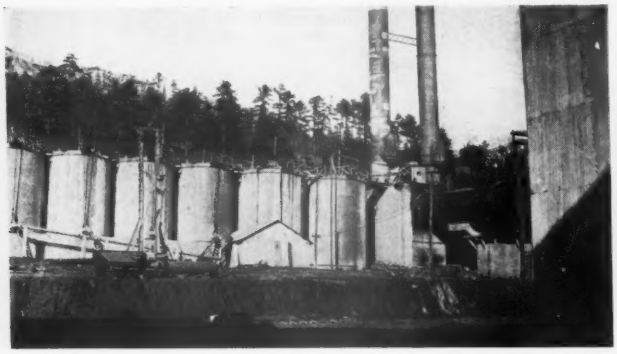
The plant is located about 5½ miles north of Chattanooga on the Dixie highway and is served by a belt-line railroad which connects with nine roads in Chattanooga. It is very close to the Tennessee river, making it possible to provide for water transportation. In all, the company owns 406 acres, which contain an abundant supply of high-calcium limestone; included in this tract is a 75-acre deposit of clay, 25 ft. in depth. The clay deposit is removed from the quarry and will be developed as an individual operation. It has no overburden and the clay will be loaded by steam shovels.

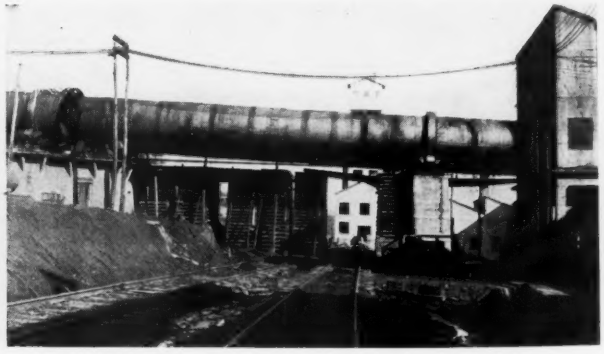
### *The Quarry*

The quarry is about one-quarter of a mile from the plant, and at the present time has been opened to a length of approximately 800 ft., and the face averages about 30 ft. in height. When fully developed it will doubtless be 2000 ft. long and its face will average from 150 to 175 ft. in height. Fortunately, the clay found in seams and pockets during the quarry's development is of an excellent quality and is being used in the mix.

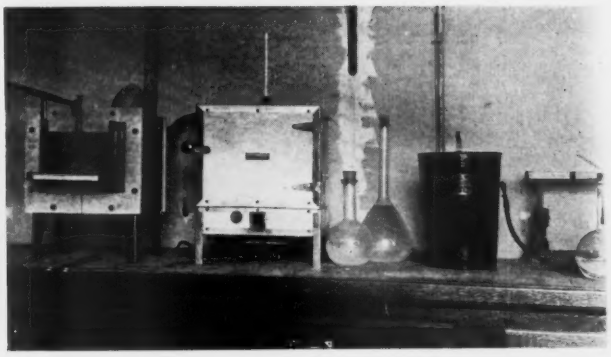
Big blast-hole drilling is being done with two No. 14 Sanderson Cyclone drills, while the secondary drilling is done by Chicago Pneumatic Tool Co. No. 8 jackhammers and Ingersoll-Rand Jackhamers. The quarry has its own compressed-air plant, the primary

*General view of the quarry which is still in the first stages of development*

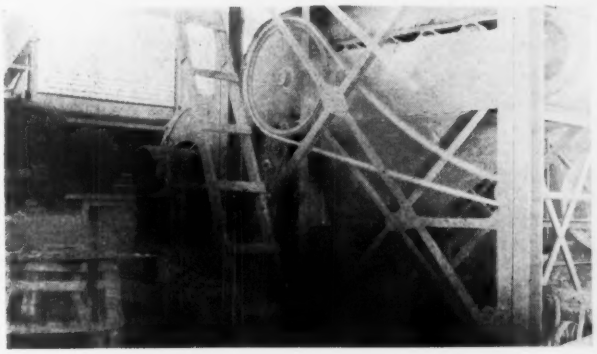




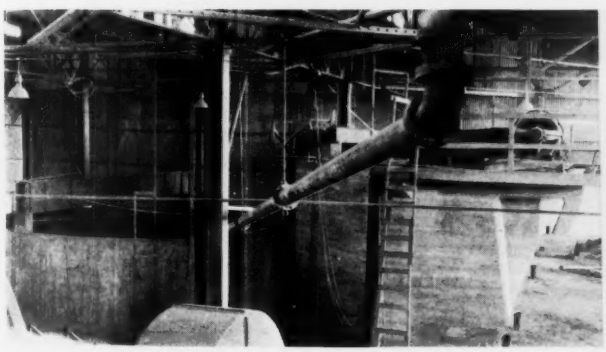
*Left: The steel blending and storage tanks. They have a combined capacity of 6000 bbl. Right: The kilns which are 175 ft. long and 11 ft. in diameter*



*Interior of the laboratory and close-up of equipment. The balance table is of concrete to insure freedom from vibration*

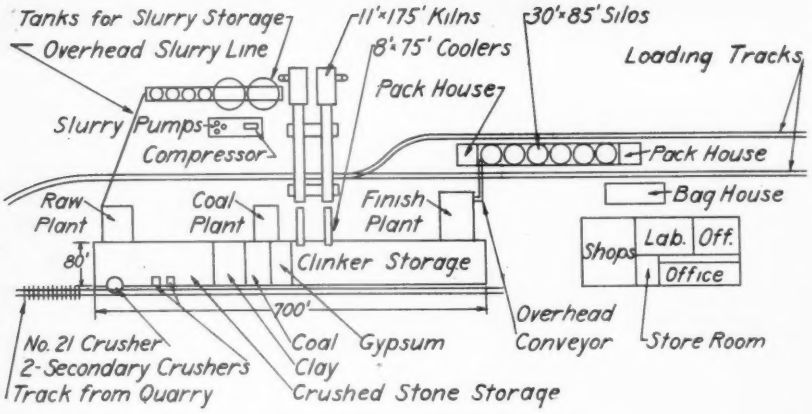


*Left: The two hammer mills for secondary crushing. Right: Discharge end of coolers. The curtain over the end of one at the left is to reduce the draft*



*At the left, interior of raw-grinding plant, showing slurry tank and wash mill. Right: The silos which hold 15,000 bbl. each*

*These two views show both ends of storage, the raw end at the left and clinker end at right. The 6½-ton crane carries a 2½-yd. bucket*




***Ground plan of plant and adjacent buildings***

unit of which is a Chicago Pneumatic 15-9x10, OCB-RH compressor, driven by a 125-hp. Allis-Chalmers induction motor.

Quarry cars are loaded by a standard railroad-type steam shovel, an 85-C Bucyrus. It is served by two trains, each composed of five 16-yd. Western air-dump cars and a 50-ton Baldwin locomotive. All trackage about the quarry and plant is standard gage, 60-lb. rail. Water for use in both quarry and plant is pumped into a 100,000-gal. tank, which sets several hundred feet above the plant, by an Allis-Chalmers centrifugal pump with a 10-in. suction and an 8-in. discharge. The pump and its 60-hp. motor are set up in the bottom of a concrete silo, 8 ft. in diameter by 30 ft. high. Approach to this odd pump house is made over a foot bridge with reinforced concrete piers. The reason for designing a pumping station of this type was to overcome the usual high-water difficulties. The pump house will be accessible and its machinery can function irrespective of river stage. The pump is said to be capable of filling the 100,000-gal. tank in three hours.

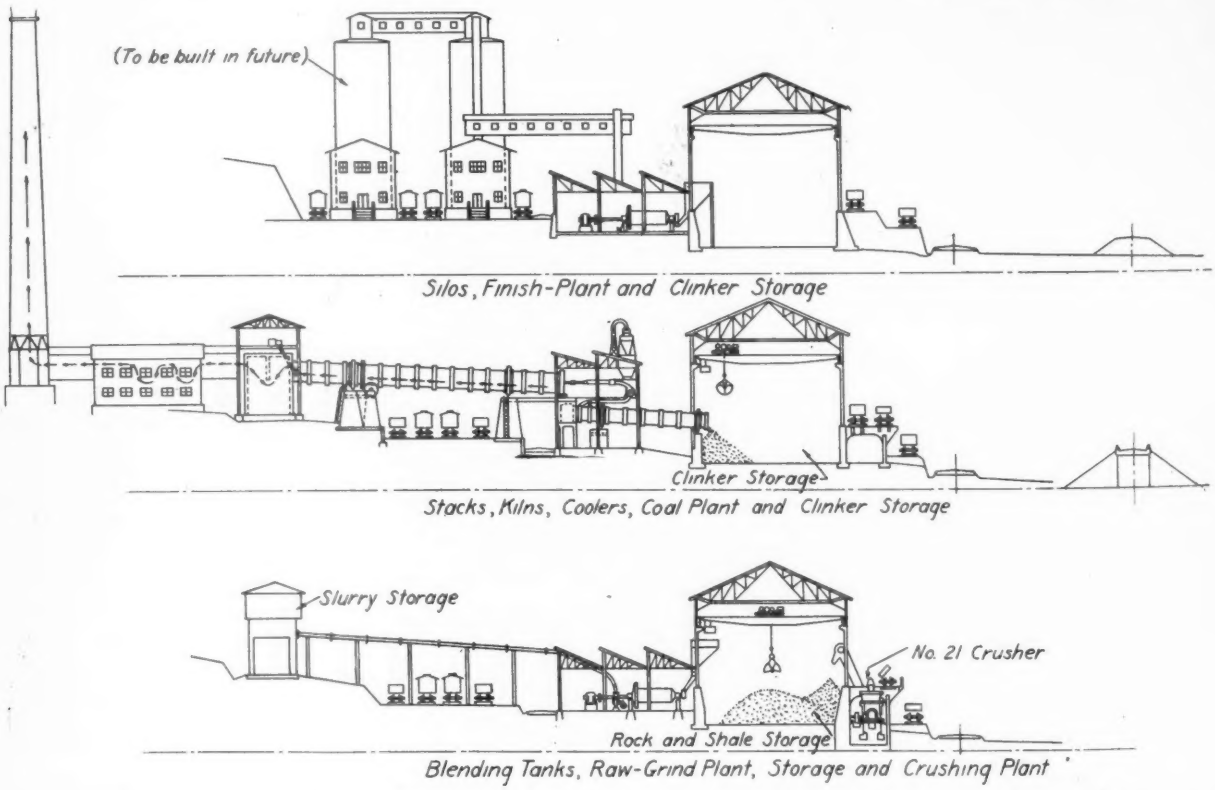
### *Crushing Plant and Storage*

A concrete trestle parallels the storage which is approached over a single tracked incline of slight pitch. The crushing plant is at the top of the incline so that the large dump cars are on level track while dumping into the primary crusher. This is a No. 21 Allis-Chalmers gyratory and is driven by a 200-hp. motor. It discharges at 8 in. directly into a 36-in. all-steel pan conveyor, which empties into a 75-ton capacity steel storage bin set above the two secondary crushers. These machines are Model W2 Williams swing-hammer mills, each driven by a 150-hp. motor. They are fed by grizzly

SIGNAL MOUNTAIN
PORTLAND CEMENT

COWHAM SYSTEM

*This trademark is another link in the Cowham Co.'s chain*

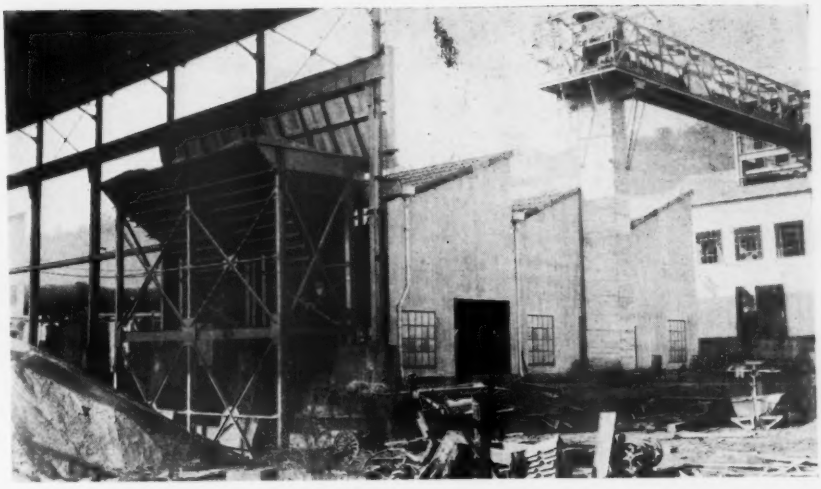

(To be built in future)
Silos, Finish-Plant and Clinker Storage
Clinker Storage
Stacks, Kilns, Coolers, Coal Plant and Clinker Storage
Slurry Storage
No. 21 Crusher
Rock and Shale Storage
Blending Tanks, Raw-Grind Plant, Storage and Crushing Plant

***These three sections show arrangements of the different parts of the plant and the course of materials***

feeders and are set to discharge at 1¼-in. directly into storage.

The storage building is 700 ft. long and 80 ft. wide and was designed to accommodate 150,000 bbl. of clinker, 15,000 tons of crushed stone, 5000 tons of clay, 5000 tons of coal and 2500 tons of gypsum. In the writer's opinion, the craneman, who pilots a 6½-ton Shepherd electric traveling crane with a 2½-yd. clamshell bucket, will be the busiest man on the job, for his duties will be many. He moves the stone, from where the secondary crushers discharge it to the center of the storage; he must keep the storage tank, which serves the raw grinding plant, filled with stone; likewise the wash mill with clay; he handles the coal into storage and then out of it to the coal plant; clinker from where the coolers discharge it to a central part of the storage; clinker from storage to the finish plant, and also the gypsum.

The outline of the services rendered by the crane justifies the statement made in the subhead of this article to the effect that this plant is a "model of simplicity." It is evidence that the plant is designed to be labor-saving and as compact and flexible as possible.



*The finish plant, showing the concrete elevator shaft and conveyor gallery leading to storage*

*This 85-ton shovel, with the 50-ton locomotive and 16-yd. cars, keeps a surplus of stone at the plant all the time*

### *Raw-Grind Plant*

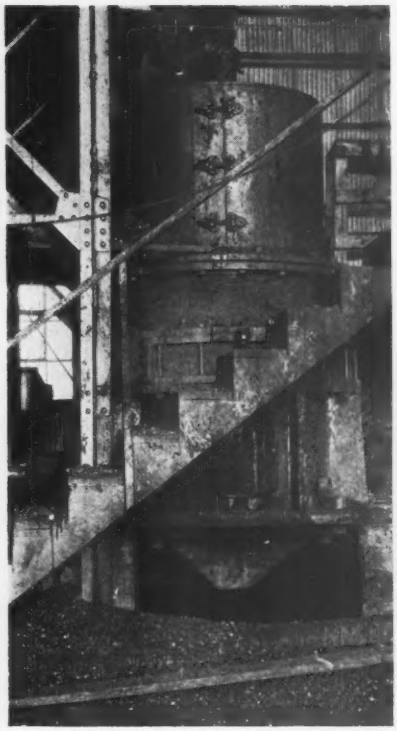
On one side, and paralleling the storage, is the track which serves as an inlet for raw materials, while on the other side are the raw-grind plant, coal plant, finish-grind plant and coolers. The raw-grind department is opposite the crushing plant so that the raw materials receive a minimum of handling. The crane deposits the crushed stone in two steel bins of 75 tons capacity, which are mounted above two 7x22-ft. Allis-Chalmers compeb mills. From these bins the stone flows uniformly into the compebs through a rocker feeder.

Clay is deposited by the crane in a steel chute and moves by gravity into a 26-ft. wash mill, the agitators of which are driven by a 75-hp. motor, direct connected by an American High Speed Chain Co. drive chain. From the wash mill the clay is diverted to a 30-ft. concrete slurry tank, from which it is pumped by a 4-in. centrifgual pump through a 6-in. line to a steel slurry control box. The overflow from the control box moves by gravity directly into the compebs. The compebs are driven by 500-hp. synchronous motors through Cutler-Hammer magnetic clutches.

From the compebs the slurry empties in a concrete sump, or box, provided with a 16-in. spiral conveyor. A Pennsylvania Pump & Compressor Co. class 3-A compressor, driven by a 30-hp. motor, furnishes air for the clay slurry as well as for the Fuller-Kinyon equipment in the coal plant adjoining. The slurry is pumped from the slurry box by a 4-in. rubber-lined centrifugal pump, driven by a 40-hp. motor, through a 6-in. overhead line to any one of four steel blending tanks of 290-yd. capacity each. Each of these tanks has five 1¼-in. pipe lines for their compressed-air control. Air is furnished by a Chicago Pneumatic Tool Co. compressor, size 15-9x 10, type OCB-LH, which is driven by a 100-hp. motor.

In the same building housing the compressor is a battery of 4-in. centrifugal

*The pump is placed at the bottom of this water-tight "silo" so that it is out of danger during periods of high water*



*One of the two 46-in. pulverizers in the coal plant*

pumps for handling the slurry between the four blending tanks and two larger tanks of 600-yd. capacity each. From the storage tanks it is pumped into small tanks over the feed end of each kiln. These tanks are provided with overflow pipes which return it to the storage tanks, thereby insuring a uniform flow to the kilns at all times.

### *Kilns and Coolers*

The two kilns are 11 ft. inside diameter by 175 ft. long and are driven by 75-hp. motors with variable speed control. Their slow speed is one revolution per 4 minutes and 15 seconds and their high speed is one revolution per 2 minutes. The kilns are lined for a distance of 80 ft. from the firing end with 9-in. firebrick and the remaining distance with 6-in. They are fired with pulverized coal by the Fuller-Kinyon system, using size 9, type PB American Blower Co. fans, which are driven by 25-hp. motors. The kilns discharge into 8x70-ft. coolers driven by 25-hp. motors, which in turn discharge directly into storage.

### *Coal Plant*

The crane deposits coal from storage in a 75-ton capacity steel tank in the coal drying and pulverizing plant, from which it is fed by a reciprocating feeder to a 24-in. belt conveyor equipped with a Ding's magnetic separator. Underneath this separator is a washtub, which was, at the time of the writer's visit, partially filled with scraps of iron and steel. The coal, after being discharged over the magnetic pulley, empties in a 30x30-in. Webster single-roll crusher, driven by a 50-hp. motor. This machine empties into an 8x55-ft. "Ebro" dryer, the product of which is elevated to steel storage tanks over the two pulverizers. The latter are 46-in. Fuller-Lehigh mills and are driven by 100-hp. motors.

### *Finish Plant and Storage*

The finish plant is served, like the raw and coal plants, by two 75-ton capacity steel storage tanks, which are within the reach

*The conveyor from the storage tanks to the crusher. It is equipped with a magnetic separator*

of the crane. From them the clinker is fed by rocker feeders directly into two 7x26-ft. compebs, which are driven by 500-hp. synchronous motors through Cutler-Hammer magnetic clutches. The finished cement drops from the compebs into a 16-in. spiral conveyor, which moves it to an enclosed chain-bucket elevator of 60-ft. centers with 18x8x8-in. buckets. The elevator discharges in a second 16-in. conveyor, which is enclosed in a structural-steel gallery leading to the silos. Here a second elevator lifts the cement to the top of the silos; from these it is distributed as desired by spiral conveyor.

There are six silos, each 30 ft. in diameter and 85 ft. high, having a combined capacity of 90,000 bbl. The silos are in one row and at the end of each is a pack house, equipped with two three-spout Bates baggers. Railroad tracks extend on either side of both pack houses, making it possible to load four cars simultaneously.

### *Laboratory and Shops*

The accompanying illustrations show that the company has provided for its chemists one of the most modern laboratories possible. Everything in it is brand new and it seems no expense was spared to make it complete. All the equipment was furnished by E. H. Sargent & Co., Chicago.

In the same building with the laboratory are the plant offices and shops. There are machine, blacksmith, carpenter and electrical shops, all of which are fully equipped so that repairs can be made on practically any piece of equipment on the job. There is another building which will be used exclusively for the repairing, sorting, cleaning and storing of bags.

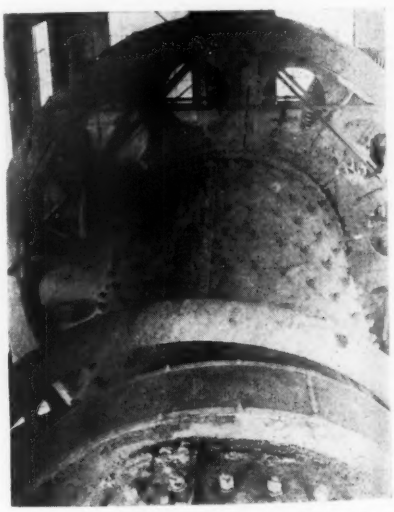
### *Equipment Standardized*

Wherever it was possible to do so, the company has standardized its equipment throughout the entire plant. All of the conveyors and elevators, which were furnished by the Chain-Belt Co., are of the same size and type; all of the pumps, furnished by Allis-Chalmers, are alike. The same company also furnished the kilns, coolers, compebs, motors, dryer and the slurry equipment.

Another notable feature of the plant is the minimum number of elevators. There are only six in the entire plant, including two in the pack houses. All of these, excepting that in the crushing plant, are small and inexpensive to operate. This is made possible through the fact that advantage was taken of the natural contour of the ground in designing so that a considerable part of the moving of materials might be done by gravity.

### *Future Plans*

The most interesting fact in connection with this plant's design is that it can be enlarged to four times its present size without, in any way, affecting or interrupting the operation of the present layout. The present crushing equipment is said to be capable of taking care of an eight-kiln plant which



*One of the 7x22-ft. Compebs in the raw-grinding plant*

*Mouth of the No. 21 gyratory which will take any stone the steam shovel can lift. Compare with the height of the man at the left*

would produce 10,000 bbl. per day. The present raw and finish grinding plants, as well as the coal plant, are adequate for a four-kiln plant, so that to increase to double the present capacity, the company needs only to install two additional kilns and coolers. To increase from four to eight kilns would necessitate the installation of another raw plant, coal plant and finish grinding plant. All of these proposed future installations are possible, without disturbing the present layout, inasmuch as space has been reserved for all the future equipment mentioned.

John L. Senior, president of the Peninsula Portland Cement Co., is president; J. L. Caldwell, president of the Tennessee Stove Co., vice-president; C. S. Steward, vice-president; J. P. Hoskins, treasurer; Paul S. Steward, assistant secretary, and W. A. Sadd, chairman of the board. The operating staff includes John L. Senior, general manager; A. C. Deer, plant manager; R. S. Conner, chief chemist; C. C. Ferris, quarry foreman; W. L. Kiser, master mechanic, and B. R. Albert, local construction engineer. The plant was designed and built by the Cowham Engineering and Construction Co., Chicago.

# Wisconsin Mineral Aggregate Association Meets

THE Wisconsin Mineral Aggregate Association, in which are included both crushed stone and sand and gravel producers, held its annual meeting at Hotel Pfister, Milwaukee, on the afternoon of Dec. 20.

The association holds monthly meetings and for this reason there is little to be done at the annual meeting but to elect officers for the ensuing year, hear the report of the executive secretary and discuss plans for the year to come in a general way.

It was the latter part of this program which was introduced by President J. K. Jensen, when he read the article of the constitution in which the aims and objects of the association were set forth. It seemed to him that the association might go farther than it has hitherto in forwarding some of the association's purposes.

Following this, there was a discussion on the propriety of the association acting as a credit association, with perhaps the added feature of using it to collect slow and bad accounts. But no action was taken on this matter and there seemed to be some doubt as to whether or not the association could so act. In this connection, Mr. Hubbard of the Janesville Sand and Gravel Co. spoke of the law that had just been passed by the Wisconsin legislature, which made it a felony for the contractor to pay out money received on any job for any other account than that of the labor and material used in the particular job on account of which the money had been paid. This applied to public work only, but it would be of great value in safeguarding the material dealer.

I. M. Cliquinoi, secretary-treasurer, read the financial record for the year, which showed that the association had nearly $12,000 cash in hand besides other assets. On this account the executive committee had decided to cut the dues ⅛c per ton, bringing them to ¾c per ton. Of this, ⅛c will go to the Good Roads Association, as before, and it seemed to be the sense of the meeting that this ⅛c had been well spent.

Norman Wilson, executive secretary, read his annual report which covered the association's activities for the year. In connection with the state highway work, he said that 1,800,000 tons of aggregate had been shipped by members of the association for the making of concrete highways. Owing to the work of the association the "peak" of the highway work had been moved forward two months. It was now the rule that at least one-third of the aggregate needed for a job must be in stockpiles before actual construction on the job was begun. Ninety-eight per cent of the highway program for 1923 had been reported as complete. For the ensuing year the program was satisfactory, as it was in effect the same in mileage as for 1923.

In the matter of inspection of highway material the association had co-operated with local engineers with gratifying results. The matter of tolerance in sizes below ¼ in. in gravel had been taken up with some success.

In connection with the Wisconsin Concrete Products Association, the matter of a suitable aggregate for concrete products had been thoroughly investigated. It was shown that the use of a clean and graded aggregate permitted a ratio of 1 to 7 in cement as against 1 to 5 which was necessary with other aggregate in order to produce blocks of the strength required by the specifications of the National Concrete Products association. This amounted to a saving of 1½c per block in the cost of block making.

The association has been busily engaged in publishing the necessity of screened and cleaned aggregate in making concrete, and it now has a mailing list of more than 2,000, engineers, architects and contractors, etc., to whom such matter is regularly mailed.

The nominating committee, which had been appointed in the early part of the meeting, presented its report which was that the present officers and directors should be continued in office. These are: President, J. K. Jensen, Janesville Sand and Gravel Co.; vice-president, J. D. Orth, Davis Bros. Stone Co.; secretary-treasurer, I. M. Cliquinoi, Wisconsin Sand and Gravel Co.; directors, A. J. Blair, Lake Shore Stone Co.; R. C. Brown, Cook and Brown Lime Co.; Louis Lann, Elkhart Sand and Gravel Co., and E. E. Gillen, Waukesha Lime and Stone Co.

The annual banquet of the association was held in the ball room of the Hotel Pfister in the evening, and 150 members and guests with their ladies were seated about small tables which were so placed as to leave a large open space for the entertainers in the center. "America" was sung before the dinner was served. After the excellent meal had been disposed of, professional entertainers, dancers and singers, furnished an entertainment of a very high class. There was a lot of chorus singing in which everyone joined with a will, and this was unusually good.

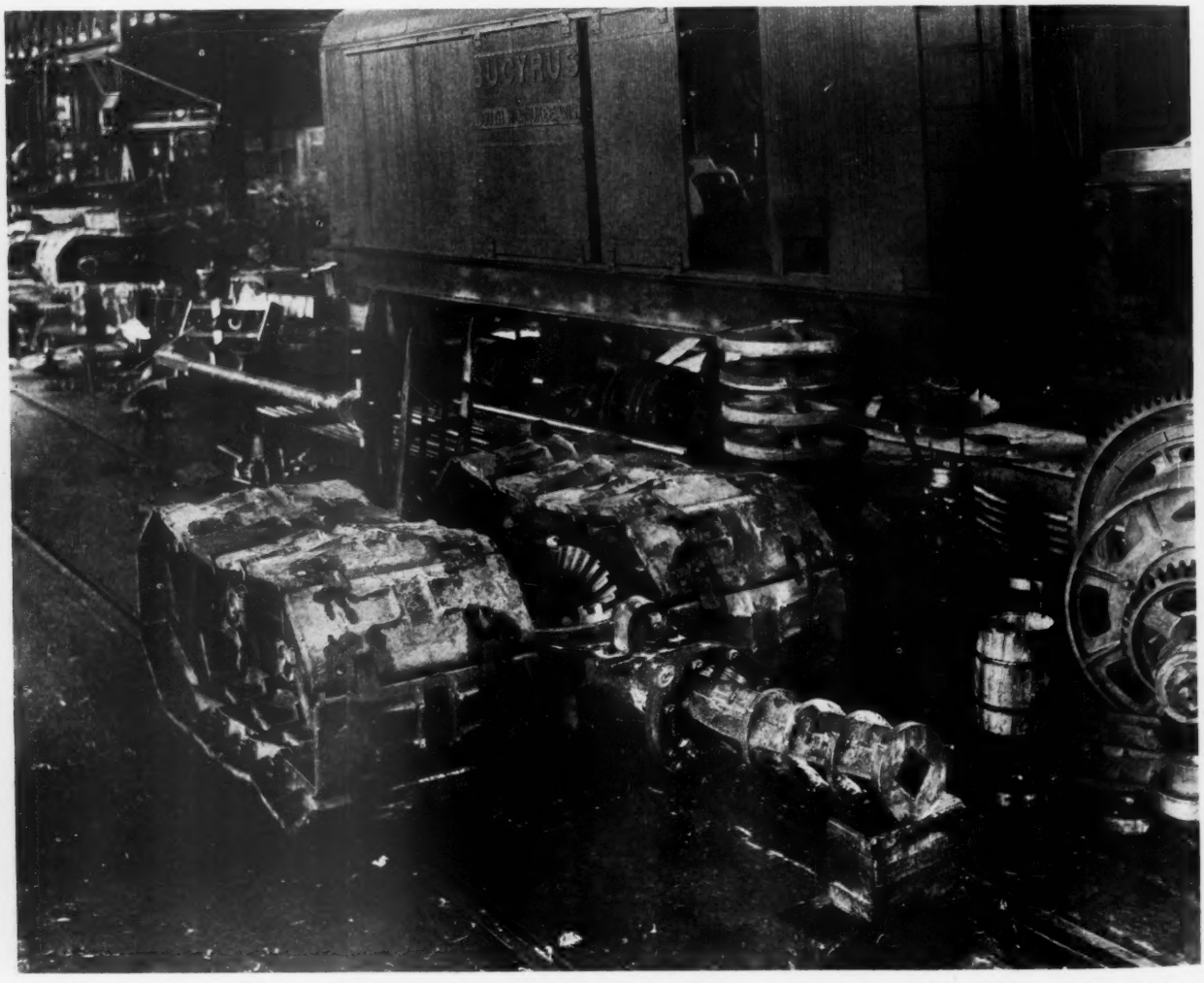
# Caterpillar Mounting vs. Railroad Type Shovels for Quarries

By Bradlee Van Brunt
Bucyrus Company, South Milwaukee, Wis.

IT is now nearly two years since caterpillar mounting was first applied to railroad type shovels. At the time that this installation was made, in February, 1922, in the quarry of the Kelly Island Lime & Transport Co. at Marblehead, Ohio, this important innovation was heralded as the greatest improvement in steam shovel manufacture since John Souther first pulled the levers on his old wood and steel "mill" nearly 85 years ago.

To those who are not familiar with the details of steam shovel operation, the organization of the pit crew and the daily routine on the quarry floor, this proclamation may not have registered as it was intended it should. With the many installations that have followed this first one in rapid succession the past two years, there should be ample time to find if this statement is as extravagant as it sounded, and whether it sings a different tune to those who know the meaning of the steam shovel's whistle, when the operator calls his pit crew to the laborious task of shifting the track sections, releasing the jacks, setting the rail clamps, watching the heavy machine roll up and the resetting of the jack, preparatory to the resumption of digging.

Within the past two years perhaps 70 such installations have been made on shovels of the so-called 100-ton class in mines and quarries in the United States, not to mention a not inconsiderable number in foreign countries. In order, there-

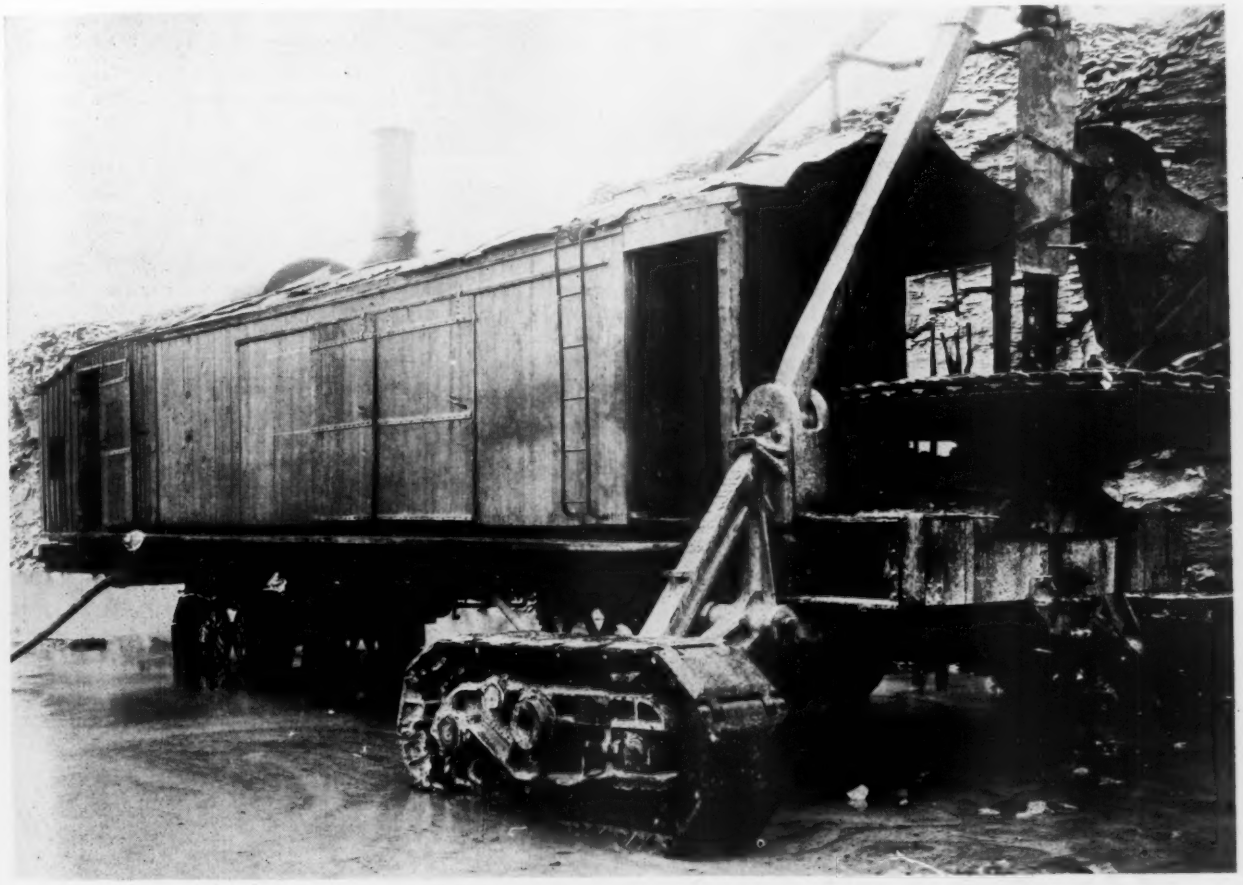



*A view of rear caterpillar assembly. The shovel is steered by means of the rear caterpillars. On some types of shovels the rear caterpillars are propelled. In the type most used on quarry floors and other hard footings they are non-propelled*

fore, to ascertain as accurately as possible whether the claims of the manufacturers of this new device could be relied upon for such service as is found in a quarry the writer sent a questionnaire in which all of these claims were set forth, to each quarry which had made such an installation, asking the experience of each.

In this article the answers received are assembled, in an endeavor to show as clearly and accurately as possible whether such an investment is warranted in the average rock quarry or slag plant.

In the great majority of cases these mountings were installed under old shovels in the field, which had already seen many years of such vigorous service as only a quarry can offer. These shovels were Bucyrus 68C, 88-C, 95-ton, 95-C and 103-C types, and Marion models 91, 92 and 100. Below will be found this questionnaire with the answers thereto summarized.



*The mounting consists of two forward caterpillars off each forward corner and two rear caterpillars mounted close together under the rear end. The front caterpillars adjust themselves to the unevenness of the ground*

### *What Did You Expect to Accomplish by the Installation of Caterpillars Under Your Shovel?*

The answers to this are enlightening. A few of them are as follows: "Saving in labor," "Increased capacity at decreased cost," "Cheaper operation than shovels with railroad truck mountings and the securing of a larger tonnage of stone with each shovel," "We expected to eliminate the lost time due to shifting or relaying tracks and setting and releasing jacks."

### *What Is the Average Number of Pit Men Employed with a Shovel Mounted on Railroad Trucks?*

The answers indicated that from four to six men were employed.

### *What Pit Crew Do You Employ on the Shovel Mounted on Caterpillars?*

Here the replies indicated that one to two men were so employed. One quarry, the General Crushed Stone Co., stated that at times two to three were used where formerly four to six had been necessary.

The elimination of pit labor averaged somewhat over 50 per cent, but ran all the way from two to four men per shovel.

### *What Do You Consider to Be the Advantage of the Greater Mobility?*

The answers to this question were all in the same vein, to-wit, the saving effected in moving time around the quarry, the elimination in lost time when moving the shovel up, the ability to keep up to the face at all times and the time saved in moving back to a new cut.

### *Do You Find That This Mounting Adds to the Digging Effectiveness of the Shovel? If So, to What Extent?*

It might be explained here that one of the principal claims for this mounting is that the digging effectiveness of the shovel is greatly increased by reason of the ability of the shovel, through numerous short quick moves, made between trains, or indeed, while swinging the boom back from the car, to keep at the most effective digging distance from the bank, whereas with a shovel mounted on railroad trucks; such moves are impossible because of the time and labor involved.

The replies seem to bear this out. The Kelly Island Lime and Transport Co., which operates a number of shovels so mounted, advise that it is possible to move to suit the digging, and to get closer to large pieces or heavy bottom, all of which is much easier on the dipper sticks. The General Crushed Stone Co. write: "We believe that the effectiveness of the shovel as regards the stone handled is increased

*The design of a caterpillar mounting for a steam shovel was not so simple as for that of some other excavators. This shows how the design was worked out for the forward end*

by this equipment from 20 to 30 per cent. The advantage of keeping the shovel at a proper distance from the face at all times lies in the consequent opportunity of the operator to handle more stone."

The Duquesne Slag Products Co., whose 103-C caterpillar mounted Bucyrus has been digging in air cooled blast furnace slag since May of this year, on an average of 10 hr. per day, emphasize that keeping up to the fact enables the operator to get a full dipper each time and permits continuous digging and thereby a gain in production.

***Is There Any Advantage in Enabling the Shovel to Back Away from Blasting?***

The Sandusky Cement Co. and the Kelly Island Lime & Transport Co. find such an advantage, the latter stating that it is easier on the front end of the shovel. The General Crushed Stone Co., on the other hand, has not found that it is necessary to back away from the blasting that is done in front of the shovel, most of which is block-holing; this holds true as well in the case of mud-capping.

***Has It Proved of Advantage in Running Away from Slides?***

This question was prompted by the writer, from one or two instances that were brought to his attention, one in particular in the case of a 103-C Bucyrus on railroad work in Kentucky where quick work on the part of the operator enabled the shovel to be moved clear of a slide of a 45-ft. bank, thus not only saving the shovel considerable damage but making it possible to resume digging in 5 min. However, the answers to this question indicated that this advantage was not so apparent in quarry operation, due to the fact that slides are very unlikely to occur under conditions normally encountered in quarry operation.

***Is There Any Advantage in the Decrease in Vibration and the Greater Steadiness That Is Claimed for a Shovel Mounted on Caterpillars?***

This question developed that the shovel on this mounting could be moved with the boom in any position and that this factor was effective in reducing repairs to a considerable extent. The greater steadiness and lack of vibration, although not an important factor in increasing output, has a decided advantage by reason of the effect on the comfort and health of the operator.

***Have You Any Figures Illustrating the Saving Per Day or Over Any Other Period of a Shovel on Caterpillars Over One on Trucks?***

The replies to this question are most enlightening. One company estimates a saving of $20 per day, due to saving in time and fewer pit men, and in addition to this is the greater production effected. Another company cites the saving made possible by being able to turn the shovel in less than 1 hr. with three men, whereas with the old style trucks at least 5 hr. with 12 men would have been required. Still another company reports a saving of $40 per day.

***Does This Mounting Increase the Output of the Shovel? If So, to What Extent?***

The Kelly Island Lime & Transport Co. answers this question with the statement that since the shovel may be kept close to the loading bank, thus permitting it to get a full bucket each cycle, its output is materially increased over a similar sized shovel mounted on railroad trucks.

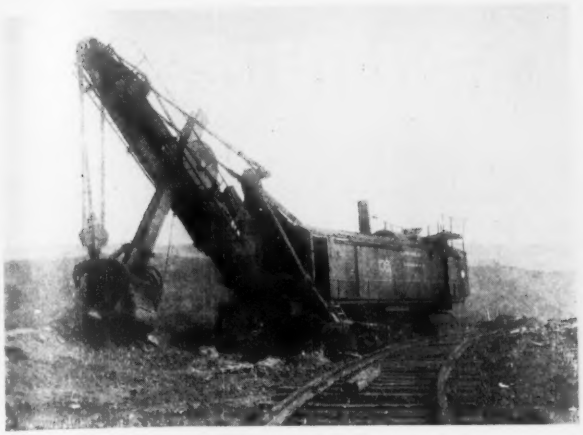
The General Crushed Stone Co. report an increase in output that "is apparently from 20 to 30 per cent for each shovel so mounted." The Duquesne Slag Products Co. and two other companies check this statement with a report of 25 per cent increase.

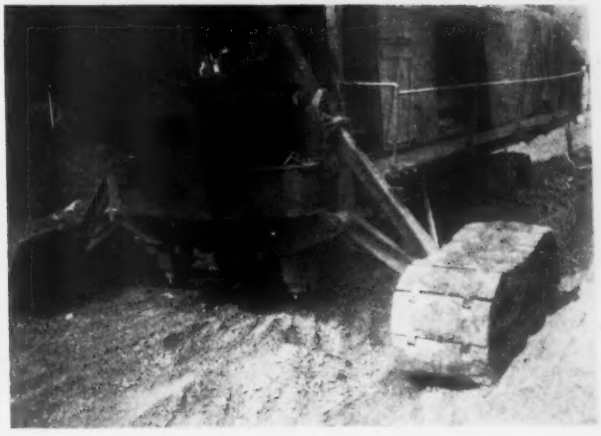
***Can You Give an Estimate of the Saving in Operating Time Effective?***

Here, too, the answers were surprising similar.

*The caterpillar can work over any kind of ground, can get as close to the face as it needs to, and can back away during blasting*

The Duquesne Slag Products Co. report about 2½ hr. per day of 10 hr.; another slag company duplicates this experience with a statement of 25 per cent. The General Crushed Stone Co. states: "It is difficult to answer this question definitely, as the saving in operating time is so dependent upon the frequency and the dis-





*Left: Railroad type shovel on caterpillars. Right: Close-up of the offset forward caterpillar*

tance which the shovel must move. In a broad general way, however, it seems to us that the saving in this regard is perhaps 10 to 15 per cent."

Another company in answering this question states that the operation of moving up requires about 10 min. with trucks and less than 1 min. with caterpillars.

***Have You Found That This Mounting Has Any Other Advantage for Quarry Operation?***

This question brought out three interesting statements. One company reports that shifting time required has been reduced from two days to about 2½ hr. Another emphasized the ease in going from one location to another where trackage was not readily obtainable, and a third points out that this mounting is advantageously used in moving and operating in water.

The final question in the questionnaire was:

***Has Your Installation Been a Success?***

The answer to this was unanimously in the affirmative.

The design of a caterpillar mounting of sufficient strength not only to support a machine of this weight, to withstand the heavy strains imposed by the rigorous service of excavation and at the same time to have sufficient flexibility to permit the heavy machine to move and turn over uneven surfaces, is not a simple problem. Although excavating machinery such as dragline excavators and tower excavators weighing from 65 to 220 tons have been so mounted with unqualified success for the past nine or 10 years, the problem of the railroad type shovel with its greater need of propelling power and mobility and steering ability has entailed more difficult problems.

In general this mounting consists of two forward caterpillars off each forward corner of the shovel and two rear caterpillars mounted close together under the rear end of the shovel.

The front caterpillars are so designed that they may adjust themselves to the unevenness of the ground.

The rear caterpillars consist of two units mounted on the same frame. These rear caterpillars as built by the Bucyrus Co. vary in length according to the character of ground the shovel is to work over, the shorter non-driven type for firm surfaces, such as quarry floors and a longer propelled type which is recommended for softer ground. The front caterpillars are propelled. Steering is accomplished through the rear caterpillars.

This mounting is so designed by the manufacturers that it may be applied to any size machine in the field.

Its success in the mining industry is well demonstrated by the fact that the two greatest open cut metal mines in the United States have placed orders for 30 sets within the past two years after such careful test as only an operation of this magnitude can make.

Contractors are using it with astonishing success under various conditions of ground and finally the non-metallic industry which originally gave the development the necessary impetus by a demand for a device of this character and appears to have adopted it as the most efficient and economical type of shovel mounting yet devised, one indeed which has a good claim on the greatest single improvement in heavy shovel design within the past quarter century.

## Illinois Crushed Stone Rate

A PROTEST against an increase on crushed stone between Thorton, Illinois, and points in the Chicago switching district has been made. The plant of the complainant, the Brownell Improvement Company, is at Thornton, on the C. & E. I., just outside the Chicago switching district, while other industries at that town on the B. & O. T. C. are inside the district. The contentions of the carriers in supporting the advance, as stated by their witness, Frank E. Webster, assistant general freight agent of the C. & E. I., the carrier publishing the suspended tariff, are that the whole structure of switching rates in the Chicago area are unduly low and, in some cases, not compensatory.

He contended that this particular traffic, which originates outside the district and is, therefore, not covered under the Lowery tariffs for the Chicago district, was not compensatory when rates as low as the Chicago district rates were applied, as they have been. The present tariff, he said, was an attempt to introduce a rate that would enable the C. & E. I. to handle the traffic at a profit.

***History of the Case***

He recounted the history of the rate adjustments on the traffic in question, saying that the charges within the district were graduated according to the number of lines that participated and adding that traffic that could not be handled entirely on the C. & E. I. could not be handled with profit. The present proposal, he said, was an attempt to restore a basis similar to that in effect before September, 1920, and was a combination of the local switching rates.

The complainants, through E. L. Maynard, traffic manager, contended that the rates would, if placed in effect, drive them out of business in the Chicago district, due to the competition of other quarries within the district. He pointed out that Chicago Heights, beyond Thornton, got the Chicago switching district basis and contended that Thornton should not thus be discriminated against.

The complainant's theory is that the difficulty is that, under the present arrangement of divisions, the C. & E. I. cannot afford to participate in the traffic and much of the cross-examination was directed to uncovering the basis of division.—*Traffic World.*

# Lime Plant With Unusual Features

## New Six-Kiln Plant Built for John Herzog and Son, Forest, Ohio, Has Many Labor-Saving Devices—Pivoted Bucket Carrier and Pneumatic Draw Shears Are Features

By Charles A. Breskin

IN a recent survey of the labor supply situation in the United States by the National Industrial Conference Board, the following statement was given out:

"Substitution of machine processes and mechanical devices for human labor in every instance possible will not only tend to solve the labor problem and bring a lower unit production cost for these industries, but aid other industries which cannot make such substitution by making more men available for them."

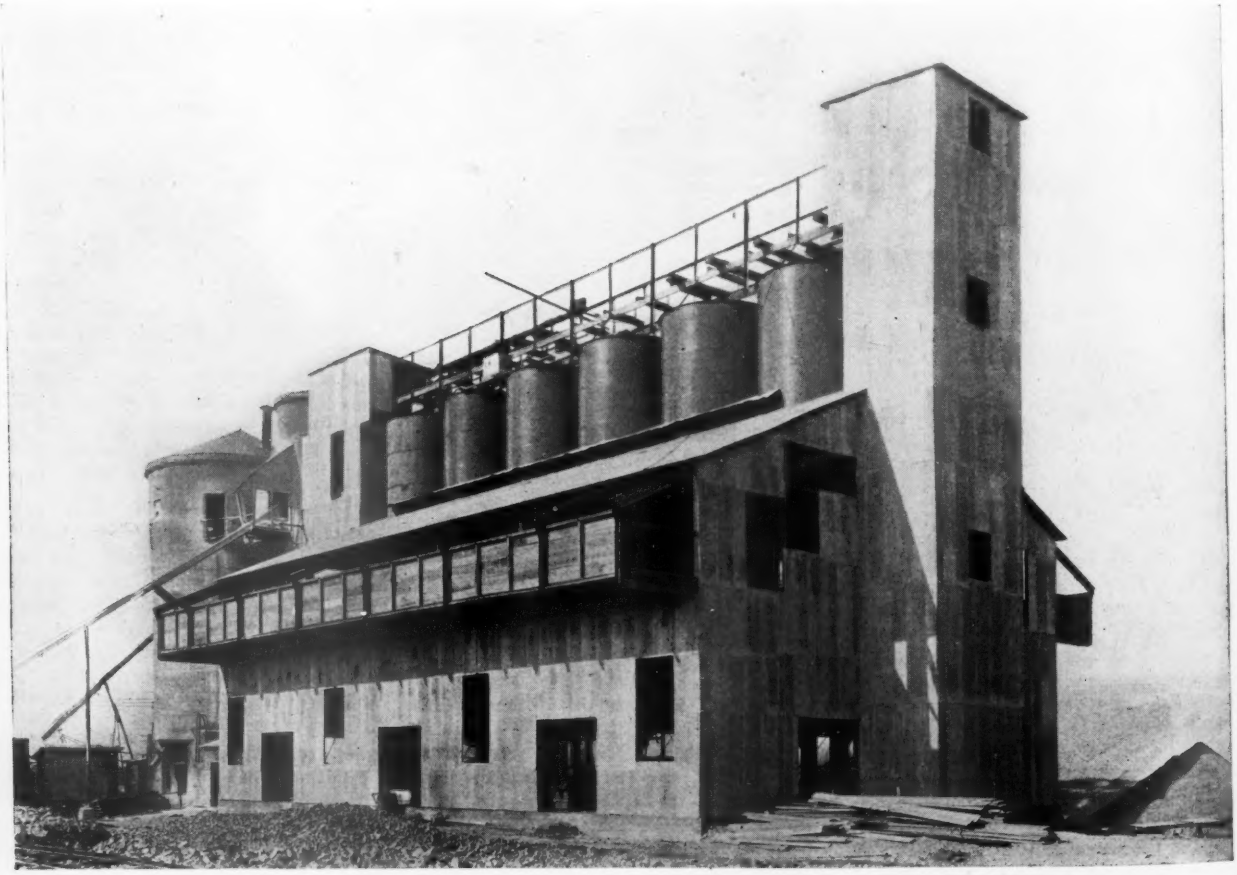
In other words, one of the ways to solve the labor shortage problem is through the use of labor-saving machinery. The manpower not available, because of restricted immigration, must be supplied by other means if industry is to carry its load.

The lime industry is one that has suffered particularly from the labor shortage. The work around a lime plant calls mostly for unskilled labor, and since the remuneration is not any too high, labor has been attracted to better paying propositions. The result of this has been the installation of labor saving devices and the new plant constructed for John Herzog & Sons of Forest, Ohio, more than reflects this. It is one of the feature lime burning units constructed in 1923.

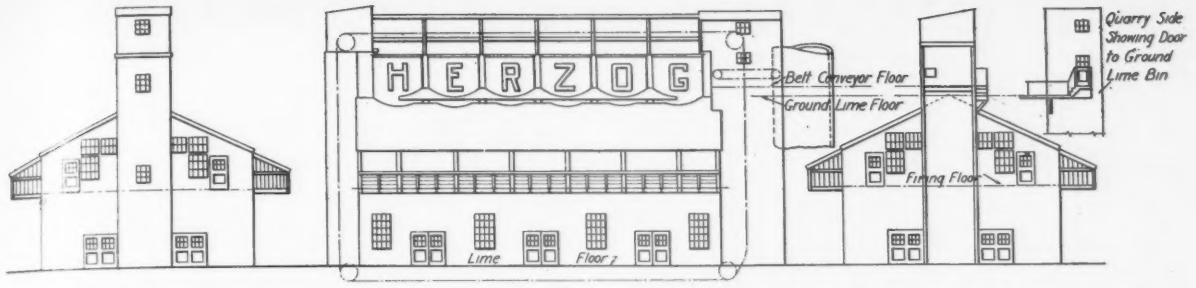
The Herzog plant is located at McVitty's, Ohio, near Forest, and is in a district producing a finishing lime that is sent to every part of the country. On the plant site is a well developed quarry and a modern stone crushing plant of 150 tons capacity per hour. Also, an old lime plant consisting of six kilns, practically all the product of which is sold to the glass industry.

### *The Kilns*

The new lime burning plant consists of six Arnold kilns, 11 ft. in diameter and 46 ft. 6 in. high, with firing floors 17 ft. above the drawing floor. They are insulated with Armstrong cork insulation brick just above the fire boxes and extending upwards to the pre-combustion zone. Stationary grates are



*The new six-kiln lime plant of John Herzog and Son which exemplifies modern ideas in lime-plant construction*

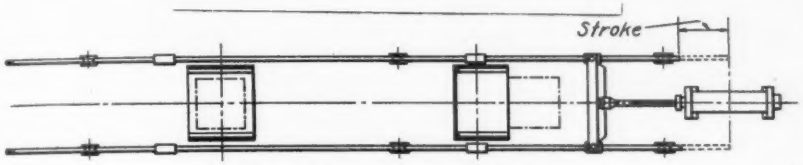



***Elevation of side and ends showing pivoted bucket carrier for charging stone to kilns. The same carrier receives the burnt lime and discharges it to a storage tank. Note cantilever construction of firing floor***

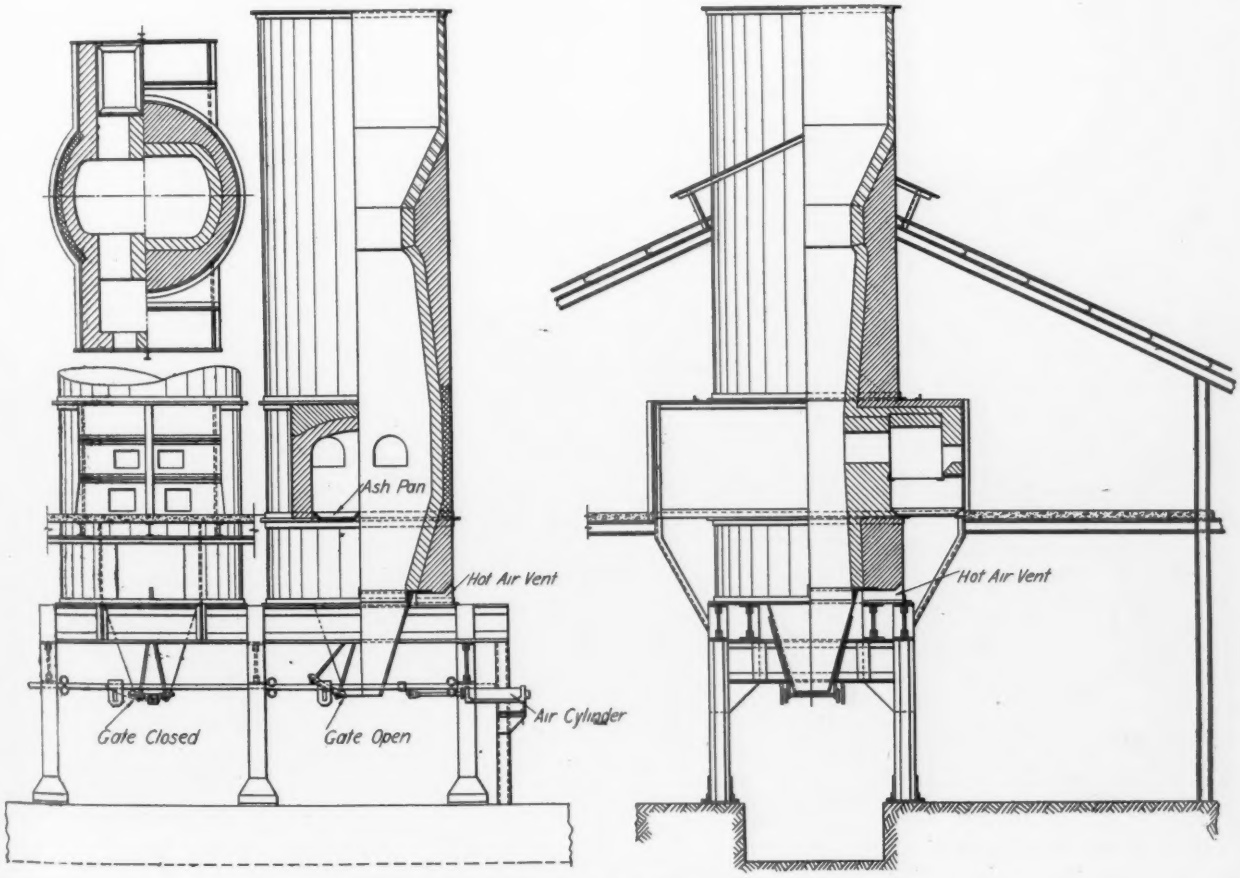
provided, with the exception of one kiln, which is fitted with McGinty shaking and dumping grates. Each kiln has a ¼-in. riveted steel shell.

The kilns are equipped with Arnold & Weigel standard coal-fired furnaces, or fireboxes, with cast iron ash pans. The storage hopper of each kiln is lined with paving brick of such a size as will enable it to hold sufficient stone for more than a day's run. The shape of the calcining chamber is such that the stone is fed regularly, thus insuring a continuous and even supply of stone at the eyes. The cooling chamber is extra large and will hold the burned lime for approximately 18 hr., thus giving a cool lime when drawn.

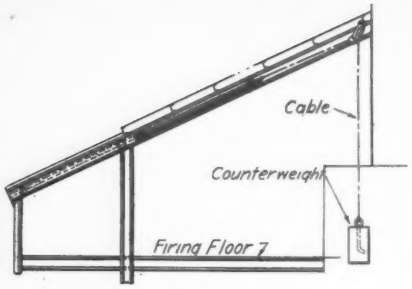
As can be seen from one of the accompanying drawings, each kiln has four air vents. This supplies the ventilation necessary to release the heat pressure in the cooler, thus easing the load between beams. It prevents the steel from crystallizing and, also when the lime in the cooler is drawn, the fine dust goes through these air vents, thus making the drawing operation much cleaner. In ordinary operations when lime is drawn, considerable dust is created which inevitably finds its way into the operator's eyes.



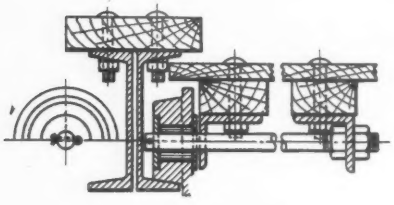

***Plan of draw shears mechanism***



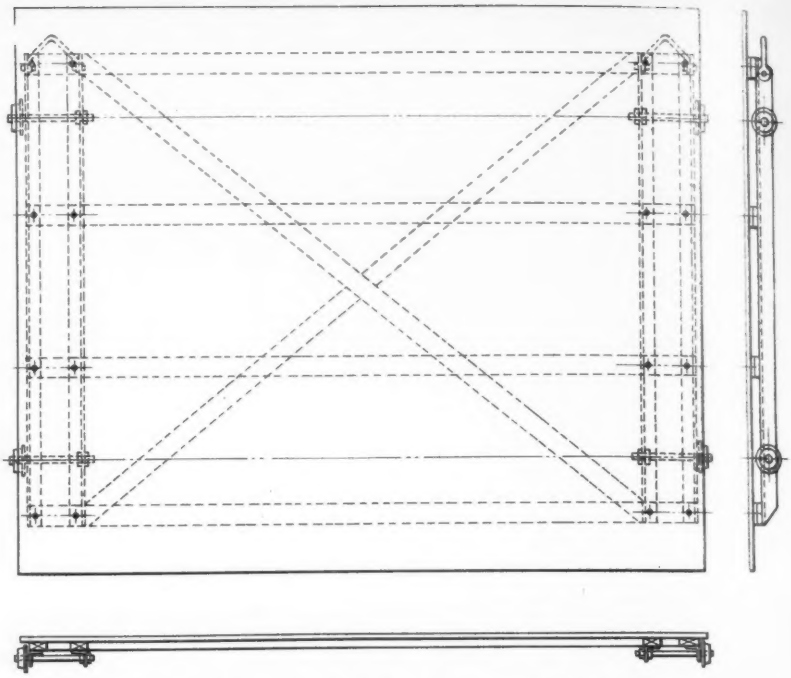

***Elevation-section through kilns supports and draw shears***




***Section through firing floor and sliding door***



***Detail of sliding door rollers***

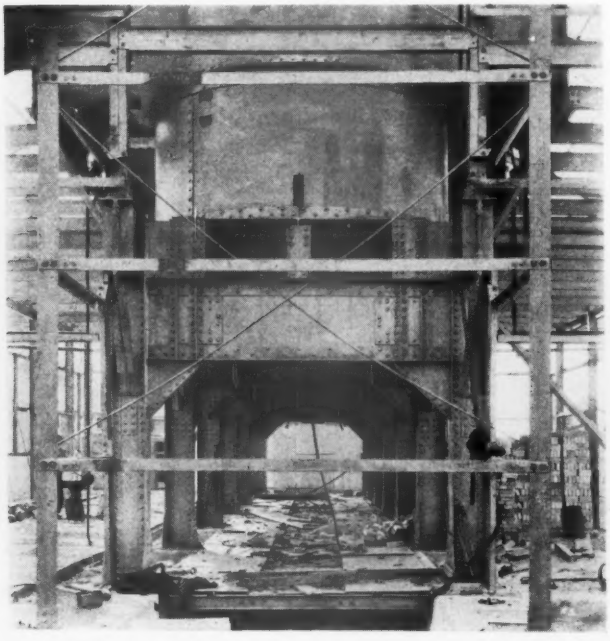


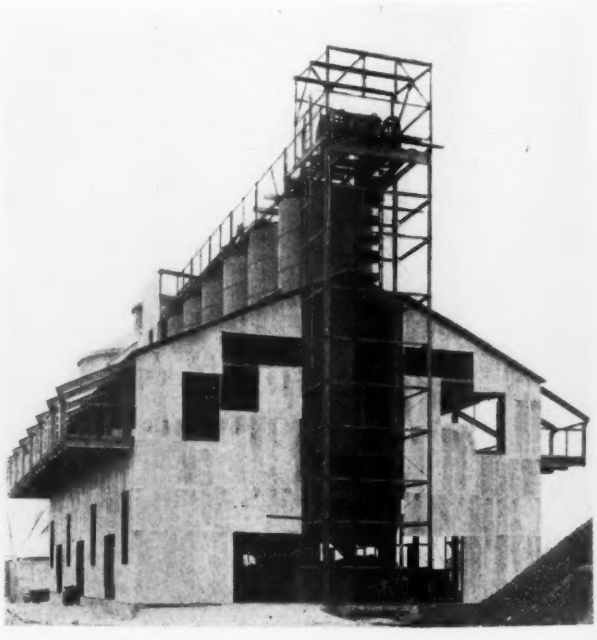
***Plan and elevation of sliding door in roof of firing floor***

The kilns are surrounded entirely by a remarkably light and roomy shed, built entirely of steel and concrete, with Armco corrugated metal siding and roofing. The roof has 22 gage metal, while the siding is of 24 gage. The building is 64 ft. wide by 102 ft. long over all, and the lime or drawing floor 48x102 ft. The firing floor extends 8 ft. out from either side of the lime floor and is laid with 6 in. of reinforced concrete resting on steel beams. All beams, columns, girders and roof trusses are of structural steel fabricated by the Massilon Bridge and Structural Co. of Massillon, Ohio.

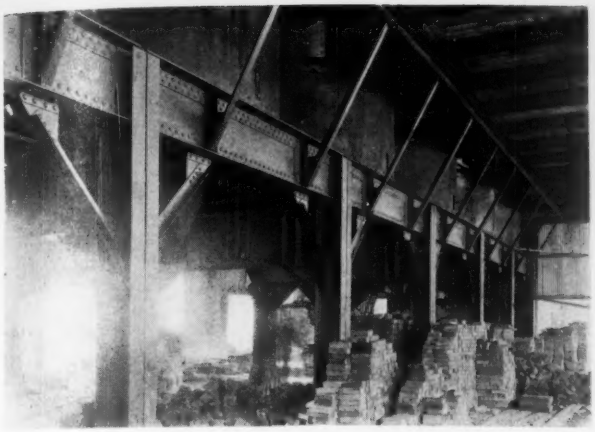
### *Feeding Stone to Kilns*

One of the features of this plant and what is practically an innovation in lime plant construction is the elimination of the inclined tramway and hoist to draw stone up to the kilns. In its stead is provided a pivoted bucket carrier which runs through the center of the plant and overhead the kilns, as can be noted from the accompanying drawings. The pivoted bucket carrier is 86⅔ ft. between centers horizontally and 50½ ft. between centers vertically. It is composed of 24x24-in. buckets and was furnished by the Stephens-Adamson Mfg. Co., Aurora, Ill.

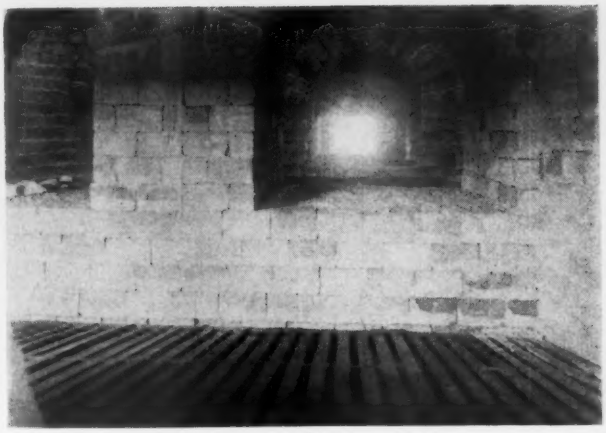




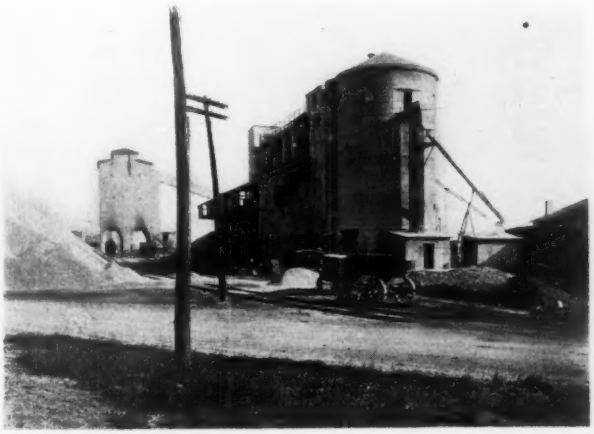
***Left: Construction details of kiln supports, cooler and lime floor. Note hot-air vent in side of kiln to relieve the uresure in cooler. Concrete runway for pivoted bucket carrier at bottom. Right: End view of plan during construction showing pivoted bucket carrier details***



*This detail shows the strength and excellent design of the structural steel supports of the kilns. ..Note the large cooling space below firing floor*

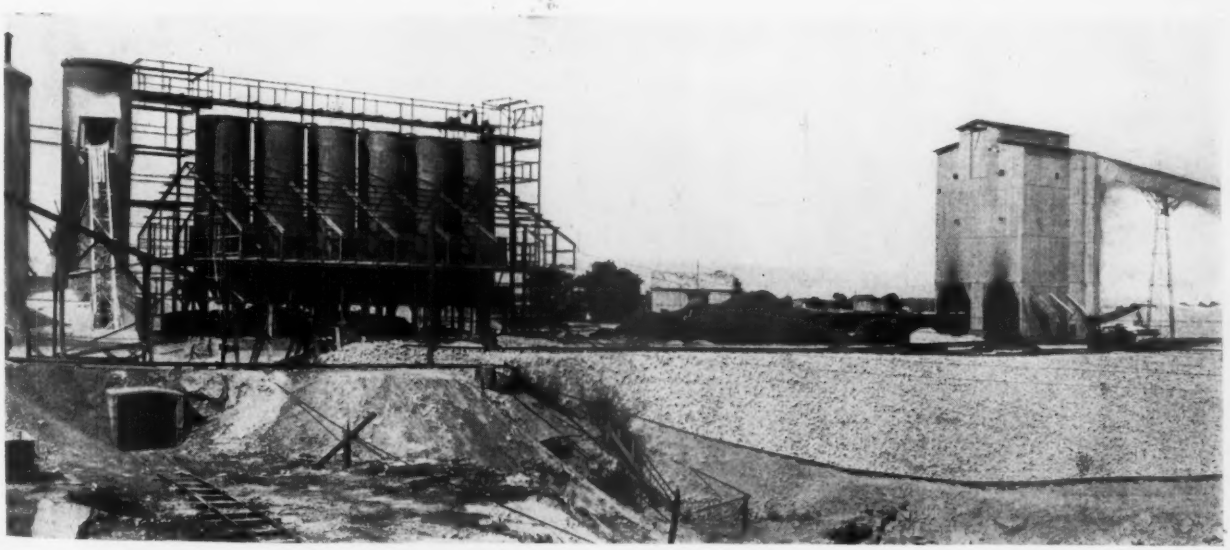


*This photograph was taken looking directly into the firebox of a kiln. Note the brick work around the arches. Note top of grates is below port hole level*



*End of lime plant with lump and ground lime storage bins. The crushed rock plant may be seen in the brackground*

*View of the quarry which shows the lower end of conveyor to crushing plant. One hammer crusher is all that is used*



*This view shows the relation of the new kilns to the crushing plant. The quarry is in the foreground of the picture and at the right in the foreground is the storage of kiln stone. A pa rt of the lump lime storage bin is shown at the extreme left*

*The firing floor. The fire boxes are standard, with stationary grates and cast-iron ash pans. One kiln has been equipped with shaking and dumping grates*

For the present, kiln stone will be loaded into motor trucks by an Ohio locomotive crane. These trucks will run directly into the plant and discharge the stone to the pivoted bucket carrier. An automatic tripper arrangement is provided whereby the stone can be discharged into any one kiln by the operator on the firing floor or on the drawing floor. Inasmuch as the stone is stored adjacent to the plant, the motor truck haul will be extremely short. The relative distances can be judged from some of the accompanying photographs. The company intends ultimately to have a 21-kiln plant and the design of the present plant is such that the new kilns will be added closer to the crushing plant. When the entire unit is completed, the pivoted bucket carrier will be extended and kiln stone will be fed to it from a belt conveyor extending from the present crushing plant.

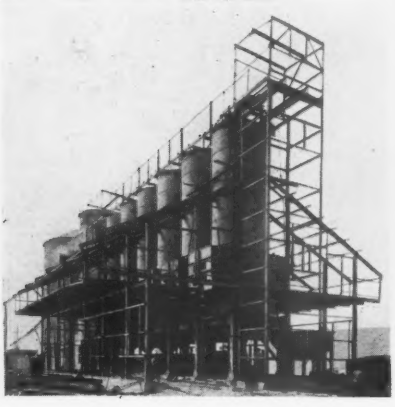
At the present plenty of stone is stored near the plant to keep it running for a considerable period. As more stone is needed it will be taken from the crushing plant in side dump cars and brought to the storage, where the locomotive crane will work.

### *Drawing the Kilns*

Another feature at this plant is the method of drawing lime. The draw shears on each cooler are operated pneumatically from one 8x30-in. double-acting Curtis air cylinder. The shear operating mechanism is shown in one of the accompanying sketches. Valves will be located near each kiln and in order to draw a kiln it will be only necessary to put a rod through the center of the gate connecting up with the pipe line on either side of the cooler operated from the one air cylinder. This is the latest method of drawing shaft kilns, and it is a great improvement over the cumbersome rack and pinion method.

The burned lime will fall into the same pivoted bucket carrier that delivers the stone to the kilns. The runway in which the pivoted bucket carrier operates is 8 ft. wide by 4 ft. high and is covered with sectional steel plate on the lime floor. Thus in drawing any one kiln or kilns it is only necessary to remove a section of steel plate. From the foregoing it can be seen that the pivoted bucket carrier serves a twofold purpose—delivering stone to kilns and receiving the burned lime.

When carrying burned lime the carrier discharges to a 30-in. belt conveyor of 15-ft. centers, which feeds a concrete lump lime storage tank of 70-tons capacity. A



*Steel work of plant and pivoted bucket carrier*

*From left to right: William Wentz, superintendent; Valentine Arnold, engineer, and Bert Herzog, general manager*

Webster shuttle feeder delivers the lime to a Pennsylvania hammer mill, from which it is elevated, screened and conveyed to a pulverized lime tank of 400-tons capacity. It is then delivered to box cars for loading or to a hydrator plant, which is under construction at this writing.

Another feature at this plant is the method of delivering coal to the firing floor. It will be noted from the accompanying sketches that the firing floor was offset 8 ft. from either side of the building. This was done so that railroad tracks could be run adjacent to the plant and coal be put on the firing floor with the locomotive crane. The floor is 17 ft. above ground level, which gives the crane sufficient boom reach to drop the coal right through the sloping roof of the building at the cantilever extension.

The roof at this point is fitted with sliding doors, running on cast iron wheels fitted with roller bearings in the channel beam supports. The doors are covered with metal sheeting and are suitably counterweighted. Thus when coal is needed at any kiln it is only necessary to raise the door. The plant has 14 sliding doors in all. The arrangement is weather proof and makes a highly efficient method for delivering coal to the kilns.

***Personnel***

Bert Herzog is manager of the plant, which is a partnership composed of John Herzog, founder of the company, and his son, William Wentz, is superintendent. The entire engineering for the new plant was done by Arnold & Weigel of Woodville, Ohio.

# The Ohio Dolomite Association

## New Organization Will Study the Possibilities of Dolomite

ROCK PRODUCTS feels somewhat flattered that it has been influential in attracting the attention of lime manufacturers to the possibilities of dolomite. Beginning as far back as 1917, we began to point out some of the special qualities of dolomite and dolomitic limestone. Indeed much has now been forgotten about dolomite, that when resurrected will give important clues to follow up in proposed research work. One such clue is an anciently known fact that a light burned dolomite has appreciable hydraulic properties.

The recent experiments of C. A. Bole, head of the U. S. Bureau of Mine Experiment Station at Columbus, Ohio, in burning dolomite under pressure, and thus obtaining the effect of a light-burned dolomite, have apparently attracted the attention of a number of live Ohio dolomitic lime manufacturers. The results of these experiments were published in Rock Products about a year ago.

Shortly afterward the idea of following up the possibilities mentioned editorially at that time took definite shape, and we are now at liberty to announce the perfection of these plans in the organization of the Ohio Dolomite Association, with Tyrrell B. Shertzer, engineer-manager, and headquarters at Columbus, Ohio. Mr. Shertzer was formerly district engineer of the National Lime Association at New York and is well known to both the lime and cement industries. This association has been formed for the purpose of making an intensive study of dolomite both as to the physical properties of the rock itself for use in concrete, macadam, bituminous pavements, etc., and also of the products from the rock, that is a study of the present known products and investigations as to the development of other products.

It is the present intent of the association to equip and establish a complete

*T. B. Shertzer*

physical and chemical laboratory in Columbus for the purpose of routine testing, research and investigation. A special committee of the membership has been appointed and is now at work on the details of this proposition.

At the present time there are seven subscribing member companies, as follows:

The Kelley Island Lime and Transport Co., Cleveland, Ohio.

The Dolomite Products Co., Cleveland, Ohio.

The Woodville Lime Products Co., Toledo, Ohio.

The National Lime and Stone Co., Carey, Ohio.

The Ohio Hydrate and Supply Co., Woodville, Ohio.

John Herzog & Son, Forest (Hardin County), Ohio.

The Lucky Lime Co., Luckey, Ohio.

Two more large companies have made application to join and three additional companies have indicated interest in the movement.

The association has only two officials, namely, G. H. Faist, president (Mr. Faist is connected with the Woodville Lime Products Co.), and the afore-mentioned engineer-manager.

The association is not incorporated, but probably will be later. It has a regular monthly meeting and such special meetings as business in hand might call for.

## Three Serious Accidents from Caving of Gravel in Roadside Pits

THREE accidents have been reported lately, two of which resulted in deaths, from the caving of gravel which was being loaded in roadside pits. Such accidents are almost unknown in regular sand and gravel operations where the men do not have to approach the bank that is being dug, and where they are trained to watch the ground for signs of caving. The newspaper reports of the accidents are:

Volney Wilcox, aged about 40 years, Caro road contractor, was killed while working in a gravel pit near Imlay City, Mich., when a landslide occurred and burried him under 10 or more feet of gravel. It required an hour to unearth the body. Mr. Wilcox and crew of men were working on a contract of road in the vicinity of Imlay City. He was married less than two years ago.

Matthew Burgler, 43, of Kalamazoo, Mich., was killed when a ten-foot embankment caved in upon him as he was loading his wagon with gravel. The dead body was not extricated until about an hour later by the police. He is survived by a widow and three daughters.

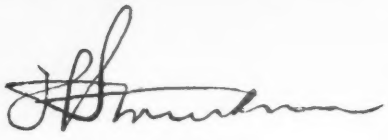
R. D. Williams, of Pennville, Ind., narrowly escaped serious injuries at the Twin Hill gravel pit when he was caught in a cave-in. He managed to keep his head from being submerged and escaped with torn ligaments in his right leg. His horse was also partly covered with gravel.

# Review of Cement for the Year

## The Banner Year!

By H. Struckmann
President, International Cement Corporation, New York City

WHILE 1923 has been the banner year of the portland cement industry in the United States, 1924 promises to be at least equal to 1923, although we believe the demand will be more evenly distributed during the coming year. In the early spring months of the current year, on



*H. Struckmann*

account of an apparent shortage of cement, we were confronted with a "runaway" market which was only checked by a stable market price at a time when cement for prompt delivery was at a premium.

If our forecast for the coming year is reasonably accurate, with a consistently steady demand and undisturbed conditions within and without the industry, we anticipate no material price increase. The fact that portland cement is being sold for approximately one-half cent per pound, which is cheaper than any other manufactured commodity, will in our opinion gradually compel smaller mills to increase their capacity in an effort to reduce their cost of production, all of which will tend to stabilize the manufacturing cost, as well as the price of the commodity.

Our labor conditions, generally speaking, have been very satisfactory and our turn-over comparatively slight, due in a great measure to providing our employes with clean working conditions and pleasant surroundings in the camps and townsites, and also to the constant effort made by our company to co-operate with our employes in the many problems confronting them in their daily life.

In regard to the quality of our product, our company believes that there is one element which has not been thoroughly covered in the present specifications, and that is the element of uniformity, which we consider just as important as fineness, setting and tensile strength. Our company believes that the wet process offers the ultimate solution on this point and there is unmistakable evidence that other companies are giving greater consideration to the wet process and it is our opinion that within the next five or ten years very few, if any, dry process plants will be built.

In regard to railroad service during the past year, with the exception of the strike period the car supply at our different plants has been satisfactory and unless unforeseen circumstances develop, we believe it will continue so. Freight rates, which constitute such an important item in the ultimate cost of cement to the consumer, will always be a great factor in the industry. However, we feel that high freight rates with adequate service is much to be preferred to lower rates with poor service, and for that reason we are not opposed to transportation rates which give reasonable compensation to the carriers.

## Truly, the Concrete Age!

By Frederick W. Kelley
President, The Helderberg Cement Co., Albany, N. Y.

THE PRODUCTION and shipments of portland cement in the United States for the eleven months of the calendar year 1923, each exceed by about 12,000,000 bbl., or approximately 10 per cent the totals for production and for shipments in the whole year 1922.

Notwithstanding this large increase in consumption, the total stock of cement on hand, which in January, 1923 was less than last year, is on December 1 greater than one year ago.

The output and shipments for the whole year 1921 have already been exceeded by approximately 30 per cent in the eleven months of this year.

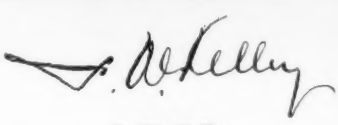
These figures reflect the wider realization and deeper appreciation of the usefulness and efficiency of portland cement concrete in supplying the needs of modern life. This is truly the age of concrete.

The figures also show that this industry, now about 50 years old in the United States, and soon to celebrate its centennial as a world industry, is vigorous enough to fully adjust itself to the needs of this country and continue to maintain its producing capacity sufficient to amply care for the demand. Operations have been started during the year in a number of new cement plants and old plants have in many cases increased their capacity.

The strong effort which was made a year ago to move cement to the work in the early months of the year, even if it was wanted for later use, unquestionably avoided delays due to lack of material on construction jobs, and should be a lesson for the future.

The better realization, that with proper precautions, concrete work can be carried no satisfactorily in the winter, with little additional cost, has also helped to swell the total of construction accomplished.

The railroads of the country by their really wonderful demonstration of efficiency in supplying needed transportation, are entitled to large credit for making possible much of the additional construction



*F. W. Kelley*

work represented by the additional cement shipments.

The year 1923 has been marked by the large increase in the use of cement in

home construction, where it has been found that the many good qualities of concrete, such as freedom from fire hazard, fuel economy, low upkeep, and good appearance, can be obtained at a cost comparable with the cost of less desirable forms of construction.

The large group known as "cement products" has shown a marked increase, both in the number of items included and in the volume of business done. It is in these groups that the wonderful adaptability of concrete is most fully demonstrated.

The year 1923 also stands out as a quality year in concrete construction due to the more general adoption of methods for making concrete, which were determined by years of laboratory research and proved by field practice. The personal responsibility of the maker of concrete for the results obtained is better understood and better met. This fact is of vital significance in the development of the concrete industry.

The large volume of new building permits, and the number of uncompleted projects, indicate a healthy condition of the construction industry, which is now recognized as the best barometer for sound prosperity.

The more favorable relative basis upon which building materials can now be generally purchased and the hopeful interest in an immigration law which will insure desirable citizens, while permitting the entry of workers who want to come, and whom we need, provide ample grounds for an optimistic view of the immediate future of the industry.

## Danger of Over-Production in the South

By Richard Hardy

President, Dixie Portland Cement Co., Chattanooga, Tenn.

FIGURES compiled by the United States Geological Survey indicate that the production of cement in this district for 1923 will be about 30 per cent greater than in 1922 and will exceed the 1921 production by about 50 per cent. For the entire country the increase will be about 12 per cent and 14 per cent respectively for the two years mentioned. With two new cement mills coming into operation early in 1924, bringing an increase in 1924 of approximately 10 per cent over 1923, the industry in this section faces a problem that calls for serious thought. Prospects for next year's business do not, in my opinion, justify the belief that there will be sufficient increase in consumption to take up the increased supply, consequently it will be necessary for those having the future of our industry at heart to give careful attention to the promotion of new uses for cement, and also to the bringing about of a longer construction season by promoting winter and early spring construction.

Heavy importations of foreign cement at South Atlantic and Gulf Coast ports have displaced many thousands of barrels of domestic cements during 1923 and constitute a menace to the stability of those markets during the coming year.

Car shortage troubles have been few and far between. Much praise is due the railroads for the admirable manner in which they have handled the enormous traffic of 1923. In spite of the fact that our tonnage during 1923 has been distributed over a larger territory, and of the further fact that we have served a greater number of customers than in any previous year, cars for our needs have been always available, and with few exceptions our shipments have moved to their destinations with no unnecessary delays.

# Lime Gains Opportunities in 1923

## Lime Manufacturers Have an Outlook for a Good Year

By Charles Warner

President, Charles Warner Co., American Lime & Stone Co., Wilmington, Del.

MY observations, of course, only apply to the northerly and easterly sections of the United States, which the Warner and American companies are serving with building, agricultural and chemical lime products.

*Agricultural Lime*—The purchasing power here has been poor for a year or two past for reasons that are well recognized in the farming communities. Our tonnages have therefore been correspondingly light. The financial condition of this group of consumers is, however, gradually improving and the reports of the last few months indicate that the purchasing power of the farmer will be substantially better in 1924 than it has been the last year or two. We believe that this will reflect itself in our territory in a considerable improvement in our agricultural lime tonnages.

*Chemical Lime*—This trade has been good for over a year and barring temporary and moderate reactions among some of the chemical consumers we believe that 1924 now promises as active a market as 1923.

*Charles D. Warner*

The improvement since the moderate reaction a month or two ago has been marked and we now feel confident that 1924's chemical lime tonnage will average as well as 1923's.

*Building Lime*—The same situation applies here as in the chemical lime trade since the resumption of building activity the last month or two as indicated by the new building permits and contracts let for 1924 construction certainly indicates a reasonably active market. It will probably not be quite as strong as 1923, but it cannot help but be good.

Taking the situation as a whole, we therefore look on a general average consumption of lime products for 1924 as strong as we have enjoyed for 1923 and we believe that the lime manufacturers in this section of the country should have every cause for gratification upon the 1924 outlook. Two or three months ago this situation did not look anything like as promising, but today we can look forward with assurance for a good year's run ahead of us.

[A very interesting statement of the present tendency of the lime industry, by W. R. Phillips, general manager of the American Lime and Stone Co., appears on page 115 of this issue.—Editor.]

# Tonnage of Lime Greatest of Any Year Since the War

By George B. Wood
President, Rockland-Rockport Lime Corp., Rockland, Me.

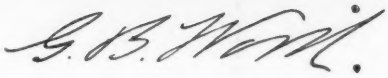
THE outstanding feature of the business year 1923 which materially affected the lime industry was the building construction activity which began early in the year and continually grew to record figures. This condition existed in practically every section of the United States, and the tonnage of lime used for construction purposes in the year 1923 has undoubtedly been greater than during any year since the pre-war period. The shortage of housing facilities in practically all of the principal cities and industrial centers has only been partially relieved, and there is every indication that a vigorous building program will be continued during the year 1924. This class of construction, apartment houses, school buildings and private homes, calls for greater quantities of lime than any other type of building, and the lime industry can look with confidence for a possibly even greater demand for its product during the coming year.

The use of hydrated lime as an admixture in cement concrete has increased in popularity with contractors and engineers to such an extent that in many sections of the country it is today adopted as standard practice. This use of hydrated lime probably represents the largest increase of new tonnage for manufacturers who market their lime for building construction purposes.

Car shortage and difficulties with transportation seem to be a thing of the past, and there are no marked indications of any serious labor difficulties to be reckoned with in the immediate future. There is still an acute shortage of skilled brick masons and plasterers, and this situation has been helped but little by any of the various forms of organized effort to produce new apprentices. However, a great deal has been learned by experience, and it is not entirely improbable that within the coming year there may be created an appreciable number of new workmen, who will have sufficient training to be of value to their employer and will ultimately help to refill the rapidly depleting ranks of skilled brick masons and plasterers. Without men skilled in these trades it is impossible to build houses to a standard of permanence befitting the American people.

The market for agricultural lime did not show a corresponding increase in 1923, due to the general lack of prosperity to the farmer for a considerable portion of the year. There would appear, however, to be many indications of a demand for agricultural lime in the spring of 1924 far in excess of conditions maintaining during the present year.

The use of lime as a chemical reagent has been for a number of years the largest single consuming factor for the lime producing industry. The tonnage consumed is directly proportionate to the prosperity and operating conditions of the iron and steel industry, the pulp and paper industry and more than 100 other diversified industrial chemical processes, and although some few of these industries are not optimistic with regard to the coming year's business, I believe it safe to predict that the tonnage of lime consumed for chemical purposes during the year 1924 will be the largest in the history of the lime industry.



*George B. Wood*

I view the lime business today with a more optimistic outlook for its future than at any other time in its history. The industry today is passing through a period of complete rehabilitation. The application of modern scientific knowledge is radically changing plants for the purpose of cheaper and more economical production as well as the improvement of the product. The industry is rapidly changing from old-fashioned to modern methods of marketing its product, and the growing knowledge of "what lime is" and "what lime may be used for" is helping the industry to intelligently distribute its product in a manner which will insure the healthy growth of the industry at large.

By united effort through the National Lime Association many of these possibilities are being developed into realities which promise much to the industry as reward for its diligence. The modern lime industry recognizes the true value of its product and the many possibilities for future development. The stability of any manufacturing industry depends upon a normal and continuous growth of legitimate markets to absorb its product. The lime industry today is systematically developing new products, reaching out into new and ambitious fields of sales endeavor, and creating by its own efforts new outlets for its valuable and indispensable product. Only under such conditions is there sound and economic justification for a program of plant expansion calling for the construction of additional modern lime kilns in many parts of the country where limestone of known suitable quality exists.

## European Lime Kilns—Erratum

THE EDITOR'S attention has been called to a typographical error on page 31 of the article "European Lime Kilns with Fuel Ratios of 16 to 20 Per Cent." In the 12th line from the bottom of the first column where it is stated: "In certain cases the coal consumption has been reduced to 10 per cent." This should have read 16 per cent, as noted in the caption of the article.

## Reported New Cement Plant for Osborn, Ohio

PLANS for the erection of a large cement plant at Reeds Hill, in the vicinity of Osborn, Ohio, are reported to be complete.

It is said, the options which have been taken on 12 farms in that locality during the past summer passed into the hands of Texas interests, planning to begin immediate construction of the proposed plant. The firm, it is said, also operates a plant in San Francisco and one in the South.

Reports that a cement plant would be built on the site have been current for several months. The first rumors were the Wabash Portland Cement Co., with headquarters at Strawn, Ind., would build a plant on the site. Later developments indicated the Texas interests had obtained the land.

# Crushed Stone Industry Prospers

## A Big Output with Low Prices and Keen Competition

By W. W. Boxley
President, W. W. Boxley & Co., Roanoke, Va.

OUR production for 1923, as compared with 1922 and 1921, was greater, there being a larger demand for ballast and commercial stone for highway construction.

Our improvements for year 1923 consisted of installing new scrubbing plant for washing the stone and making it absolutely clean; both railways and highways demanding all stone to be absolutely clean and free from dust. In addition to the scrubbing plant, we have electrified our Pembroke plant and all machinery is being driven by electricity generated by water and brought to us from a distance of approximately twenty miles. This scrubbing plant has improved the class of stone very much and our output has been increased somewhat. Both the scrubbing plant and electrification are very satisfactory.

Labor conditions have been bad, very scarce, and inefficiency very marked, with wages increased. Prices have been low; competition keen.

The changes in specifications have been with a marked tendency towards smaller stone for both ballast and commercial purposes, 2-in. perforations being the maximum, and quite a demand for the smaller sizes, ¾-in. to ½-in. for road surfacing.

Prospect for business in 1924 is hard to arrive at. A bond issue for $50,000,000 in Virginia failed and our only source of revenue for highway construction is from the gasoline tax. Ballast requirements for railways uncertain, the quantities used being governed largely by amount of business done by the railways. The coal business, which is the railways' greatest business, has been very slack and if this continues we do not expect as good a ballast season for 1924 as for 1923.

Efforts are being made to have the highway department store stone, but this has not been consummated, and inducements are being offered the railways to open up their season April 1 with a small output, say 20 per cent of normal, and increasing to full capacity of ballast season by June, and running full until November 1 and then graduating down. Our attitude towards lengthening the season has been fairly well expressed in the previous paragraph. If the highway engineers could be induced to store stone at their nearest points of delivery on railroads and allow the contractor sufficient estimate to cover the cost of material and freight, we think this would bring about a longer construction season.

At our Pembroke plant we are installing a hydraulic washing plant, pumps to be driven by electric power, and we also contemplate electrifying our Blue Ridge plant this winter.

Our car service from the railway company has been fine and we take this opportunity of saying that we believe that our car supply and railway's handling of stone from our quarries is as good as can be had.

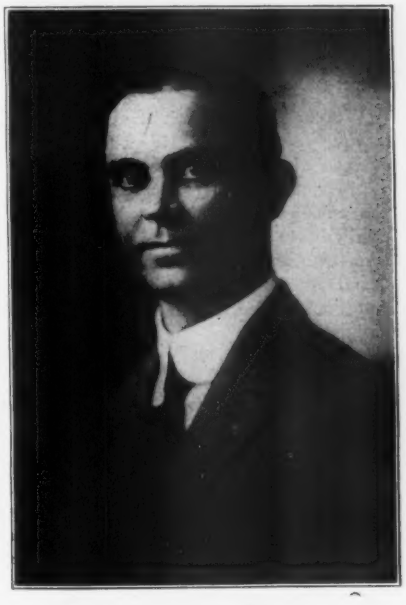
When we have a full car supply and quick action in the handling of our product to our customers, the freight rates that might sound a little high do not hurt us nearly so badly as they would if we had poor service.

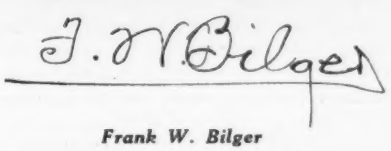
## Crushed Stone on the West Coast

By Frank W. Bilger
President, Oakland Paving Co., Oakland, Calif.

AWAY OUT on the West Coast we have the City of Oakland practically at the very western extremity of the United States, and I am pleased indeed to respond to the request outlined by you.

The production for the year 1923 has been considerably greater than for the previous two years. The trend of immigration seems to be westward and consequently this situation could not have been otherwise.





*Frank W. Bilger*

By way of reference I might say there is quite a distinction here between the crushed stone industry and the crushed gravel industry. This is quite apparent for the reason that in the southern portion of the state the gravel producers have a much better field because of the lack of large deposits of rock suitable for construction purposes. However, in the section about the Bay of San Francisco more crushed rock is sold than crushed gravel, because in this section we have a number of very productive rock quarries.

During the present year we have expended quite a large amount of money which enabled us to handle our product entirely by mechanical equipment. Previous to this time the rock was broken by hand, so that we have eliminated much manual labor by the addition of equipment. Our production has practically doubled on this account.

Labor conditions in this section have changed considerably by reason of the fact that the laborers which we formerly had in our quarry were Italian and at the present time they are not coming to this country. The wages of the present force have been increased to a considerable extent and I find that we are getting a higher class of labor than ever before. Modern equipment such as we have installed naturally requires considerable judgment and head work.

Prices here have remained the same for at least two years. Competition has been clean and since there has been no price cutting our producers have enjoyed the benefits of fairly reasonable profits.

I also know that the specification requirements are upward and that the tendency is toward the use of clean blue crushed rock rather than any inferior quality of concrete material.

Judging this year's business and the business of the previous two years, I can see no reason why the prospects for the coming year should not be extremely good. Highway work is going along at a rapid pace, as well as the construction of business buildings and homes by the thousand. In fact, Oakland is today the second most rapidly growing city in the United States. Situated as we are on the east side of the Bay of San Francisco and becoming an automobile producing center, homes are greatly in demand and we find a very rapid increase in the demand for office buildings, apartment houses and hotels. In driving around the

city each day we find old structures being torn down to make way for new modern buildings. Consequently, the period that we are approaching is certainly a most interesting one.

Our operating season is practically ten months of the year and there is no possibility of lengthening this period. We are, however, this year working straight through the winter season, which, as you know, is very mild here and I can see no reason why we should not keep on building houses, as well as roads, during the entire year.

With reference to the increased production, I might say we are making a very comprehensive study of blasting and the economical handling of our products. This will enable us to meet the increasing demand for a high grade product.

Car shortages here have not been apparent during the recent year and I doubt if we will be confronted with any such problem during the coming year. The transcontinental railways coming into this section are spending millions of dollars for new equipment which leads me to believe we need not fear a car shortage.

Freight rates are not an issue in this section at the present time, since they are the same as for past years. Consumers do not question our prices and consequently freight rates will hardly be affected.

Summing up the entire situation, I can see no reason why the San Francisco Bay section should not have for four or five years to come a most wonderful lot of roadway and building construction. Most all of the cities and towns of the state are demanding new streets and roads and even throughout the farming sections new roadways are being constructed so that our crushed stone and gravel and sand producers need fear no lack of business.

# Sand and Gravel Has a Busy Year

## Purchasers Show More Concern About Quality

By Alex W. Dann
Vice-President and Treasurer, Keystone Sand and Supply Co., Pittsburgh, Pa.

THE SAND AND GRAVEL INDUSTRY has enjoyed a very busy year in Western Pennsylvania and reports indicate large activity in most sections. Our company has, for the first time, found demand exceeding capacity. To meet this condition, a plant for the reduction of gravel to sand is nearly ready for operation and a new digger will be completed during 1924. The new digger will be larger than our present largest digger and in design along the same general lines.

Alex W. Dann

*Alex W. Dann*

During 1923, our company put in operation a new plant for car and truck distribution at Munhall. For the first time, we have made distribution of material by truck in the city of Pittsburgh. In 1924, we expect to sell a greater tonnage than in 1923, since we look for building to continue active in this section and hence, the additional tonnage can be absorbed.

As a general thing, we find purchasers showing more concern about quality and we welcome this interest upon their part. It tends to make the final product of the construction industry, which is the competed structure, more secure and with that greater dependability, our prosperity increases.

We consider the freight rate issue still a vital one. The railroads now get about 20 per cent of our tonnage instead of 97 per cent which they did get before the rates got so high and which they might have largely retained. Still our tonnage goes up. Producers in this section have another case before the Interstate Commerce Commission to be heard early in January. Many markets now closed would be made open were the carriers to publish rates on sand and gravel comparable with those on crushed slag.

It is certainly in order to commend the carriers for the manner in which they have provided freight transportation this year. It is a most agreeable improvement and we must not lose sight of the fact that our industry in the main had a good car supply in spite of the tremendous tonnage handled by the railroads. Why should our car shortage not be over? We think the carriers have demonstrated that it is possible to avoid car shortage.

## Conditions Have Been Good in the South

By Arthur P. Burke
President, Atlanta Sand and Supply Co.

CONDITIONS in the sand and gravel industry in the southeastern states are generally good. It has been a busy year and unless something unforeseen occurs we look for a continuance in 1924, though the freight problem is still uncertain.

There has been a tremendous increase in tonnage used in the year now closing, but the producer who ships has not enjoyed the full benefits owing to increased freight rates, which has caused the use of large tonnage of inferior local materials. This is particularly true in regard to sand. However, the producers have noted an increase in volume of from 25 to 50 per cent

A. P. Burke

*A. P. Burke*

over that of 1921 and 1922. Some members of the industry have been very active in carrying on an educational campaign to promote the use of good materials, through circular letter to users, architects, engineers and city and county officials, and this has been very effective in reducing the use of inferior local materials. Unless there comes another advance in freight rates indications point toward a record tonnage for 1924.

In our plant, 96 miles from Atlanta, we have been at work to double the capacity, but this cannot be completely accomplished until the railroad serving us can complete its improvements. It is an old road, taken over by the Southern Railway some years ago, and still equipped with light rails, requiring the use of small engines of the old type, the number of which is limited. Heavier rails are now being laid and we hope for adequate service before the end of the coming year.

Labor conditions in the vicinity of our plant have been most satisfactory, except for brief periods of shortage. The quality shows marked improvement, at wages approximately from 5 to 20 per cent below war time schedules. This will apply pretty well over the territory and in general construction work. While construction was at its height there was some scarcity of labor, this being largely due to the exceptionally heavy construction in Atlanta.

As to market conditions, we have been through periods of price-cutting and unfair competition, but 1923 has been marked by a great improvement over former years. This has been partly due to the demand for better grades of material, tending to increase costs of production and bringing the price-cutters nearer to a realization of actual costs to the more substantial class of producers.

Specification requirements are constantly changing toward a demand for better materials, and it is also noticeable that many contractors are voluntarily using better materials, even when not required to do so. This is most gratifying, both to the producers and to good citizens in general, as bringing about a permanent, high-class type of construction.

I would like at this point to give full credit for this, as well as to other improved conditions in the industry, to the National Sand and Gravel Association, its official organ, and to Rock Products, as well as to other publications devoted to the trade, for the high degree of educational work they have done, consistently and persistently. Facts and figures on vital policies and problems of the industry have been continually carried to the individual producer, and, unquestionably, have been productive of tremendous results.

In the railway field, while no great volume of track extension is expected in the Southeast during this year, the large amount of new equipment to be placed in service, as well as other efforts on the part of the carriers to improve transportation facilities, will naturally lead to track extensions, which should require a large tonnage of aggregate and ballast. The highway program promises to be more extensive than in several years, the southeastern states having begun to realize that hard-surface roads are necessary to progress. In the general building field it is felt that 1924 will be at least equal to the past year, so far as our industry is concerned. While conditions among farmers, which affect the smaller towns, will result in little building through a portion of the Southeast, this class of building has not used any appreciable volume of shipped sand, gravel and stone, so the industry will be little affected.

The operating season in the South is practically twelve months in the year. While from spring to fall conditions are better, the costs are raised by labor shortage, and builders are, therefore, beginning to do more in the winter than ever before. We believe in urging winter building in the interests of uniform production volume, and the industry will profit by a compaign of education to demonstrate that labor is more plentiful, deliveries more prompt, and transportation less uncertain; these and other advantages offsetting stoppages caused by short periods of bad weather.

We feel no apprehension as to car shortage for this winter, and possibly through the spring, but we should not like to risk a prediction on what may occur in the fall. Railroad policies, the fuel situation, strikes, are all elements to be considered. Who could answer for the future?

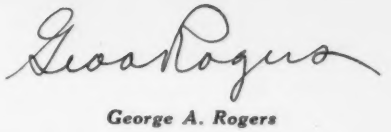
Freight rates still are an issue, but this subject has been so thoroughly covered in Rock Products, and by the bulletins of the National Sand and Gravel Association that it is not worth while to attempt a discussion in this limited article. In Georgia, however, the State Commission recently proposed a revision in rates, which was a substitute for one proposed several months ago by the carriers. The proposal affecting the sand, gravel and stone consisted of a mileage scale approximately 10 to 15 per cent lower than the scale proposed previously by the carriers. Other commodities were affected, and representatives of all shippers, as well as representatives of our industry, made vigorous protest against the publication of the proposed rates. All shippers took the position that rates within the state should not be put on a level above that of interstate rates, and that no charge should be made at this time, or until the interstate rates could be readjusted and made effective simultaneously. The carriers did not insist on the publication of the proposed rates, granting that it would create discrimination against the shippers located in the state. While no official announcement has been made, it is assumed by the best authorities that the commission will take no further action on this proposal. We are, therefore, marking time until the carriers indicate their intentions toward the proposal for readjustment of interstate rates.

On the whole, the Southeast is looking forward toward a year of progress, of greater volume, the use of better materials. The general feeling is one of optimism, borne out by the records of the past year, and the construction known to be planned for 1924.

## Heavy Increase of Business in Los Angeles District

By George A. Rogers
President, Union Rock Co., Los Angeles, Calif.

WHILE the Union Rock Co. and its predecessors have been in operation in Southern California for the past fifteen years, the present management only took over the business in April, 1922.



*George A. Rogers*

Having been less than two years actively engaged in the crushed rock and gravel business, we hesitate to speak too strongly on the troubles affecting the business, as it is possible that in another two years we may have to change some of our ideas and our present views.

This company's production for 1922 showed an increase of about 50 per cent over the year 1921. The year 1923 has been a very busy one and will show a

substantial increase over 1922. We expect our totals to show that we have shipped over 3,000,000 tons of material in the past year.

Labor conditions have been fairly good; while there was a shortage in the middle of the summer and wages were advanced in some sections, still the conditions were as a whole about the same as in 1922. The market conditions in the latter part of 1923 changed seriously, owing to the erection of a number of new plants, resulting in keen competition and some serious price cutting, some of the plants being located and distributing on motor truck hauls; so that the price situation has been a very disturbing one.

### *1924 Outlook Good*

We believe the conditions for 1924 look very good. Unless the plans of the railways, highway departments and municipalities are seriously changed, 1924 should be ahead of 1923. Anticipating this situation, on our part we are constructing a new plant which we hope to have in operation during March, 1924, which will give us an increase in production of over 800,000 tons for the next year. We have also started work on a second new plant which we hope to have running by May or June of 1924, which will further increase our production at least 1,000,000 tons per year. We are preparing to handle a gross business of 5,000,000 tons per year.

Our season is practically 12 months. It is true, in the winter time there is a period of about three months during the rainy season that business slows up to some extent, but we are delivering some material and operating the plants the year around.

The results for 1923 as stated above will show that our car situation has improved. Over 1,000 new rock cars were purchased and placed in this territory, which has helped the situation materially, as shown by the increased production. We are advised by the railroad companies that further purchases have been made and additional equipment will be available for 1924 and 1925, so that we contemplate that we will have no trouble in moving the increased production which we are now arranging for, should the market demand that amount.

The freight rates in southern California have always been higher than in northern California for some reason, not at all clear to the novice. However, this matter is now under discussion, and we are hoping that freight rates on movement of rock, sand and gravel in southern California will at least be put on as favorable a basis as in northern California. Freight rates in northern California are as follows:

***Mileage Rate Scale in Effect in California***

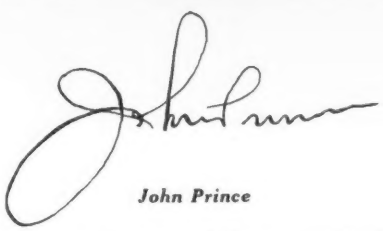
| | | |
|---|---|---|
| 40 miles and under | | $ .50 per ton |
| Over 40 miles and under | 50 | .60 per ton |
| Over 50 miles and under | 60 | .70 per ton |
| Over 60 miles and under | 70 | .80 per ton |
| Over 70 miles and under | 80 | .90 per ton |
| Over 80 miles and under | 90 | 1.00 per ton |
| Over 90 miles and under | 100 | 1.10 per ton |
| Over 100 miles and under | 110 | 1.20 per ton |
| Over 110 miles and under | 120 | 1.30 per ton |

## Middle West Has a Normal Year

By John Prince
President, Stewart Sand Co., Kansas City, Mo.

IN ATTEMPTING to review the sand and gravel business in the Middle West during 1923, it is of course somewhat difficult to limit the territory so described. I remember as a boy when living in New Jersey, that Pittsburgh certainly seemed in the Middle West, but at this time I am not going to undertake to cover any such territory.

It might easily be said that the pro-



*John Prince*

ducers in this part of the country have for the year 1923 enjoyed a normal year, that is if we had ever had a normal year by which to make the comparison. The average will probably show a production not far from the production for 1922, although there will be considerable variation. Those plants depending largely on the smaller towns and the rural population have not enjoyed even that much success, while the business of the larger cities will help bring up the average.

The real back bone of the prosperity in this section is grain, cattle and oil. All of these commodities during the past two or three years have experienced most drastic liquidation. The cattle men were probably hit first and many losses were suffered aggregating huge amounts. During the last two seasons particularly, the wheat farmers have had to sell their crops on such a basis that it did not give satisfactory returns measured in other commodities, and only now do we begin to see the recovery of the oil producers from the overproduction of the past summer. Business, therefore, has been somewhat spotted, some producers showing more the effect of these conditions than others.

It is quite evident that the capacity for production in the Middle West exceeds the demand almost to the critical point. In some sections the prices obtained for sand and gravel have not been much less than those received last year, while in others the excess of production capacity has created a disastrous price level. In those sections there will probably be fewer producers by the end of another year, but those who remain will be somewhat wiser.

### *Highway Programs in Doubt*

In this part of the country the highway program on which the eastern producers and those of Ohio, Indiana, Illinois and other states in that district have depended for a large part of their demand, have not been developed to the extend they have elsewhere. During this year most highway programs have failed to make any definite progress with the rural voters. Of course, all the farmers drive automobiles and want good roads, but they still feel that, somehow or other, somebody else should be made to pay for them. In Missouri the road program authorized several years ago is making good progress, although it is somewhat slower than many would like. In Kansas, Oklahoma and Nebraska no statewide program of hard surfaced roads is operating, although some counties are doing excellent work.

In undertaking to size up the conditions which will confront the producers next year, there are many opposing influences at work. It is exceedingly difficult to predict with any accuracy what the final results for next year will be. If they are no worse than they have been this year, we will all be relieved, and there is a possibility that they may be better. It hardly seems that the Middle West has this year enjoyed its share of the 20 or 25 per cent increase of the sand and gravel business reported for the country as a whole. All of the producers have been watching their costs with great care, hoping that economies could be effected that would still further permit a reduction in the selling price.

Out here where the West begins we are still optimistic and believe that something better lies just ahead.

# Slate Industry Developing*

## Work of the National Slate Association Is Bearing Fruit

By Oliver Bowles

Superintendent, Nonmetallic Minerals Station, Bureau of Mines, Department of the Interior, Rutgers College, New Brunswick, N. J.

SLATE has long been known as a roofing material but of late years many new uses have been developed. While roofing slate constitutes the chief single use, it embraces less than half of the total value of slate sold. As a wider knowledge is gained of the properties and adaptabilities of slate, an expansion in the number of uses and volume of sales is to be expected.

While complete figures are not yet available, it is probable that 1923 sales exceeded those of 1922 which was the banner year in the history of the industry. Slate sales for the past five years, as compiled by the U. S. Geological Survey are as follows:

| | |
|---|---|
| 1918 | $4,841,120 |
| 1919 | 6,030,648 |
| 1920 | 8,726,442 |
| 1921 | 7,322,006 |
| 1922 | 9,176,784 |

It is estimated sales for 1923 will probably exceed $10,000,000. Roofing slate sales have shown considerable recovery during 1922 and 1923 but have not reached the value of some previous years. The most remarkable expansion of the industry is in blackboards. The demand for blackboards during 1923 greatly exceeded production and in consequence, stocks were greatly reduced; orders now booked will assure capacity production for the first few months of 1924. Electrical and structural slate have shown a steady growth. The relative importance of each brand of the industry is indicated in the following table compiled by the Geological Survey for the year 1922:

SLATE SALES IN 1922

| | | |
|---|---|---|
| Roofing slate | 479,243 squares | $4,169,761 |
| Electrical slate | 1,363,300 sq. ft. | 996,322 |
| Structural and sanitary | 2,131,800 sq. ft. | 750,653 |
| Blackboard | 3,518,700 sq. ft. | 880,985 |
| School slates | 2,766,610 pieces | 42,027 |
| Billiard table tops | 383,900 sq. ft. | 87,763 |
| Grave vaults | 400,100 sq. ft. | 141,445 |
| Slate granules | 379,980 short tons | 2,177,061 |
| Miscellaneous uses | 5,500 short tons | 30,767 |
| Total | | $9,176,784 |

The National Slate Association organized in 1922 has been very active in promoting the interests of the industry as a whole. The services of a traffic expert have brought about a great improvement in conditions in transportation. A modest advertising campaign has been conducted, and such publicity has been supplemented by the maintenance of exhibition booths, notably at Atlantic City during the summer months, at the Chemical Exposition in New York City in September, and in co-operation with the trade in building shows in several other cities.

A multigraphed sheet "The Slate News Bulletin," the official organ of the association, first appeared in March, 1923. It is issued at irregular intervals to inform the membership of the activities of the association. Twenty-two numbers appeared during the year.

In June, 1923 a committee on slate of the American Society for Testing Materials was authorized though it is not yet organized. The appointment of an active committee of this character would constitute an important step in technical progress in the industry for it would stimulate research in the fundamental properties of slate. With a better knowledge of such fundamental properties a basis would be established for standardizing the product for various uses with resultant improved utilization and better manufacturing methods. The establishment of a research fellowship at the U. S. Bureau of Standards has been proposed and this idea may be encouraged when the American Society for Testing Materials Committee is in active service. Some research work on the properties of electrical slate has already been conducted in a private laboratory at Cleveland, Ohio.

In connection with tests and specifications it is noteworthy that an effort will be made at the slate meeting in January to establish basic specifications for roofing slate, and also for tile to be used in walks, floors and flat roofs. A simplification of dimensional varieties in plumbing and sanitary structural slate has already been accomplished by the Structural Service Bureau and the Structural Slate Co., and an attempt will be made at the January meeting to encourage wider acceptance of these specifications by engineers and architects.

Bureau of Mines Bulletin 218 "The Technology of Slate" by Oliver Bowles, was released for distribution in January, 1923. It contains the results of three years' study of the slate industry. In this report methods of operation and types of equipment both in quarries and mills are described in some detail. The bulletin is still available for free distribution.

An important development in quarry methods during the year was a determined effort to substitute drilling for channeling or blasting as a means of conserving a greater proportion of the serviceable rock. Three or four companies have tried out a method of drilling closely spaced holes and broaching out the cores between them. Two companies have found the new method so successful that it has been adopted as a regular quarry practice. Details of the new system are given in Bureau of Mines report of investigations Serial No. 2532.

The production of granules for the manufacture of slate-surfaced roofing has attained large proportions during recent years. As may be seen from the table given in a previous paragraph, it constitutes an important item, being exceeded only by roofing slate. While formerly the chief production has been in green and red granules, during the past year there has been an increased production of blue-black or dark gray granules. Some confusion has existed in this branch of the industry, for granules are manufactured from trap rock and other materials as well as from slate, but have been classed with slate because they are used for the same purpose. However, at a recent conference between the Prepared Roofing Association and the Division of Simplified Practice of the Department of Commerce, specifications were adopted which require that the term "slate surfaced" be used only when crushed slate is employed, otherwise the term "stone surfaced" is to be used.

The year 1923 has marked a considerably wider use of slate flour as a filler in products where other fillers were formerly used. The demands do not yet, however, absorb the production capacity of present mills, and hence there is at this time no encouragement for slate producers to build additional mills.

New and important uses have also been developed for structural slate during the year. It is now used more extensively for water tables, cornices and door or window trim, both exterior and interior. It proves to be well adapted also for floors of display windows in stores. Slate has also been used successfully in the form of structural blocks for store fronts. It may be readily carved in ornamental designs.

On January 21 to 23, 1924, the third annual conference of those interested in slate production or sale will be held at the Commodore hotel, New York City. The meeting is not confined to members of the association, and a large attendance is expected. This gathering is a time for a careful review of past conditions and accomplishments, and affords opportunity to plan for the coming year.

A better spirit of co-operation among producers and between producers and distributors has been brought about by the national association. As an outcome of such co-operation, a high standard of salesmanship and service is promoted and research is encouraged. All these factors point to a greater prosperity and increased expansion in the industry during 1924.

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# The Gypsum Industry

## Caution on Cost Data

By Dr. Frank A. Wilder
President Southern Gypsum Co., North Holston, Va.

THE gypsum industry as a whole prospered during 1923. The demand for gypsum products was well sustained, and in most localities the weather conditions during the later months of the year were unusually favorable for building operations. As a consequence, when tonnage for the year is compiled the figures will probably be larger than any previous year.

Labor conditions were more stable, and

*Frank A. Wilder*

the labor turnover was probably less than in any recent year. While the efficiency of labor is not all that may be desired, it is certainly greater than during the years that immediately followed the war.

The railroad situation showed a wonderful improvement. For the last 15 years there has never been a year with so little trouble from box car shortage. In certain districts a slight shortage during October was reported, but normal shipments were not interrupted for more than a day or two at a time. Ample equipment for loading permitted economical production, and this, taken with an unusually long season and a well sustained demand, favored lower costs.

In connection with costs, a word of caution should be added, for the benefit of any one who is studying the gypsum plaster business, with reference to cost figures set out in two or three publications, which in other respects are fairly reliable. The cost figures usually given are wide of the mark in connection with necessary overhead expenses, including selling, depreciation and amortization. In certain cases no distinction has been made between the cost of calcined gypsum and neat gypsum wall plasters.

Committee C-11 of the American Society for Testing Materials, which has undertaken to standardize gypsum and gypsum products, is making progress with the very important work assigned to it, and the society has published as standard, specifications for calcined gypsum, gypsum wall plasters and methods for testing gypsum and gypsum products. Tentative specifications for gypsum, gypsum wall board, gypsum plaster board, gypsum partition tile or block and gypsum plastering sand have also been published.

The Southern Gypsum Co., Inc., with mine and mill at North Holston, Va., added a block plant to its equipment during 1923, and extended its facilities for handling crude gypsum for cement mill use. On account of geographic location the interruption of operations due to winter conditions is short, and seasonal conditions are not marked.

## Plenty of Present Capacity

By W. E. Shearer
President, Universal Gypsum Co., Chicago, Ill.

IT IS QUITE APPARENT that the production and distribution of gypsum products is approximately 15 per cent in excess of 1922 and this increase is pretty well distributed as affecting the various products made from gypsum.

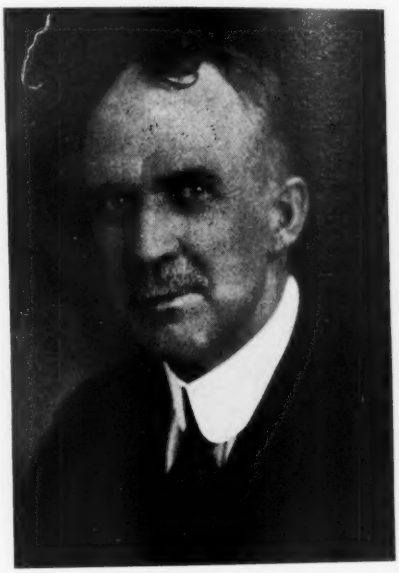
There has been a considerable increase in capacity by various manufacturers during the year, and I would say that increased production is fully equal to the increased demand; in fact I believe it has anticipated the increased use of gypsum for 1924 if not longer.

Generally speaking, labor conditions have materially improved. While there have been some advances in the scale at some producing points, improved efficiency of labor has been and is very noticeable, and there has been very little difficulty in obtaining sufficient labor.

As the natural result of increased production in excess of demand, competitive conditions have been somewhat keen but with that there has existed a healthy and wholesome market with few exceptions.

There is a continued apparent increase in the practice of architects and engineers to use gypsum for various purposes in building construction, including some of the products which have so well established themselves in fireproof buildings.

Due to increased new uses for various gypsum products, our business has become less seasonable and this is the result of a definite program by the entire industry in educating the public to uses for gypsum, which has materially broadened our markets. I think the contractor and material man can do little to bring about a longer construction season other than as influenced by climatic conditions. This applies to the use of basic gypsum material, which is plaster, and we can do little towards



*W. E. Shearer*

relieving the spring rush of business by making early spring deliveries other than at the convenience of dealers who necessarily desire to minimize their cost of operating. However the dealer can easily accomplish a great deal to the mutual interest of himself and the manufacturer by anticipating his spring requirements at least a month, having the stock and quickly serving the spring demand at its beginning—either early or late.

We have had no difficulty with car shortage throughout the year 1923 and from all indications we will have no serious difficulty in 1924. So far as freight rates are concerned, they always have been an issue and always will be in our business as all others, although at the present time we have no serious complaint or difficulty regarding this, and each and every year we find the carriers quite ready to recognize our industry and becoming more co-operative as each problem arises for solution.

# The Railway Ballast Proposition

## How One Prominent Crushed-Stone Producer "Came Back" After a Price-Cutting Controversy and the Loss of an Order

THE editor of ROCK PRODUCTS is particularly fortunate in being able to present the following letter, borrowed from the files of a crushed-stone producer who does a very large volume of business with the railways. It covers the problems of facing railway purchasing agents with a clear conscience, and emphasizes the necessity of demanding a "living wage" so fully that we cannot help believing it will assist other producers who find themselves in a similar predicament. For obvious reasons the writer's name, and all names that would identify the writer have been omitted or changed.

### *The Letter*

We are in receipt of your favor of M—— 29, and note your conclusion [to place your order elsewhere.—The Editor] Further discussion is therefore merely academic but it may have the tendency of persuading you that there are two sides to the question if and when the matter comes up again for consideration. Therefore, at the risk of wearying you and at the further risk of calling to your attention that which you already may know, permit me to present the question of price on ballast from the standpoint of the producer and especially from our individual standpoint.

For some twelve or fifteen years prior to the war we furnished you a very large proportion of your ballast requirements. We furnished it at prices similar to those made to the A. B. & C. R. R., notwithstanding the fact that the A. B. & C. R. R. took ten tons to your one. The prices were undoubtedly lower than procurable from any other source except in some isolated instances. It was most assuredly the case that no other source of supply was capable of giving you the varied service which you asked of us, such as anywhere from one to ten cars a day with almost no notice. Nevertheless, we served you through this entire period perhaps with some advantage to ourselves but with a full consideration of our responsibility to serve you without taking any unfair advantage. If I remember correctly, this attitude was acknowledged by your company and appreciated.

The break, if it may so be termed, came during the early period of the war, when it became necessary to raise the prices due to the extraordinary increase in cost. We still offered you the same price as we gave the A. B. & C. R. R., an increase, if I remember correctly, from 50 cents to 58 cents a ton. Your purchasing agent, over the telephone, offered me 55 cents and also offered a five-year contract at that price, stating that he could make a contract for 50 cents, but we declined it. I advised him at that time that it was not practicable to furnish ballast at 50 cents, nor even at 55 cents, and that we could not furnish it at less than the 58 cents quoted. He placed with us the order for the particular year 1915 or 1916, I forget which, but at the same time made, according to his statement to us, a five-year contract with the Amateur Stone Co. Incidentally we offered to him a five-year contract at 58 cents but this was refused.

I simply ask you to review the circumstances subsequent to this time as to whether the five-year contract at 50 cents was carried out and whether you would have been better off had you accepted our proposition for a five-year contract at 58 cents. I would further add that we carried out during the war every contract we had with the railroads during this period. Of course, we are now very glad your purchasing agent did not take it, as we would have suffered a very heavy loss as the result. So much for the past.

We do now recognize, however, that you have two substantial operations to play against each other on the question of price. I refer to this attitude without any unpleasant implication as to its justice, for the reason that I think the peculiarities of the situation are not always appreciated by a purchaser. A fair price for ballast is naturally made up of five items of cost.

1. Actual productive cost, and is, what is well known in freight parlance as the "out-of-pocket" cost.
2. Local overhead—that is, the executive, administration and non-productive expense at the quarry.
3. General administrative expense, including taxes, insurance, accounting, selling, and general administration.
4. Interest on investment, depreciation, depletion, and amortization of the invested capital during the life of the operation.
5. Profit.

It is perfectly apparent when there are two competing plants and where there is a certain business, such as a railroad company's, which can give it to one or withhold it, and where ordinarily there is no other business to replace it, the two competitors must necessarily recognize the value of securing it. They can first waive their profit and they still are better off, because the other expenses will be taken care of. They next can waive the interest, depreciation, and amortization because they all have to be borne anyway, whether the business is secured or not. By the same token the general administration expenses

***WHEN a railway is asked to pay a price for ballast "at least equal to the cost of production," by the cost of production meant is that computed on a basis illustrated by the following example:***

***Suppose the total tonnage produced during the year is 200,000 tons. With the plant adjusted to make 60,000 tons of railway ballast about 60 per cent of the run of the crusher is ballast stone. The average commercial business is 100,000 tons.***

| *We now have:* | *Tons* |
|---|---|
| *(a) Total tonnage* | *200,000* |
| *(b) Commercial business* | *100,000* |
| *(c) Ballast (60 per cent of the crusher run)* | *60,000* |
| *(d) Stone made in connection with ballast production* | *40,000* |
| *Total as in (a)* | *200,000* |

***The cost of producing 60,000 tons of ballast is the cost of producing (c) and (d), since the production of (d) is incidental to the production of the ballast.***

***Therefore railway ballast should pay about one-half the cost of operating the plant, including depletion, overhead, amortization, etc. Any part of the 40,000 tons (d) actually sold should be credited to the cost of ballast production at prices which the railways would have had to pay for it, if they had bought it.***

***In other words a plant which is working on a ballast order cannot afford to gamble on the possible sale of what is left over after making ballast. It must make the same provision for taking care of its commercial business as it does its railway business. The two should be handled independently except so far as the byproduct of ballast manufacture is actually disposed of as such.—The Editor.***

can be waived because they have to be borne anyway if the company is doing business other than the railroad order in question. And so down the line the fixed charges can all be waived, until it comes to an out-of-pocket cost. Just how far down the scale competitors can go in a struggle of this kind depends upon how far they can exploit some other purchaser less favorably circumstanced than a railroad company. It seems to me that the profit can well be waived, but when it goes beyond this it is ultimately bound to spell bankruptcy, and the theory of the survival of the fittest obtains. I am assuming, of course, that there is reasonable efficiency and economy in the operation.

It is on this general basis of reasoning that we have arrived at prices for ballast with other railroads. We have admitted frankly to all of them that of course they can crowd our ballast price to a lower figure if they insist upon doing it, for the reasons which I have set forth and which are perfectly obvious. I have further stated that we are willing to supply ballast without profit, but beyond this I do not think we should be requested to go. This theory has been substantially accepted, not by definite agreement but by many instances of the submission of costs over a period of years. It is the only defense we have.

You state that our prices are too high. Possibly this is true, but the question is, "High in comparison with what?" for the very reasons that I have cited. I do not doubt that you can buy cheaper than we have offered you, but I doubt if this can be done except at a sacrifice on part of the competitor. I am inclined to believe that you cannot buy cheaper out of Podunk, for the reason that we are furnishing a large amount of ballast to the Z. & A. R. R. this year and our price is based upon the price given you plus the switching charges on your road, which must be added to the ballast price in order to reach the Z. & A. R. R. I infer from this that either they receive superior service, or else they can't buy much, if any, cheaper elsewhere. The price we have quoted you is the price we have given the A. B. & C. R. R. If based on similar specifications you compare the price with that of the Q. & X. R. R. there is a difference of less than 2 cents in favor of the Q. & X., based on the producer's units of measurement, but the quantity is based on something approximating 250,000 tons during the year. The price to the M. & N. R. R. and the N. C. R. R. is 30 cents or 40 cents a ton higher, but based on different conditions, their ballast being a harder rock, which of course is much more expensive to produce. While of course you have the advantage in knowing at what you can buy, and therefore you are in a position to make comparisons when you say our price is high, is it not possible that your statement is based merely on the comparison and not on the fundamental basis of what should constitute a reasonable price?

As I stated to begin with, this discussion is probably entirely academic, and your decision this year does not seriously affect us, for the reason that we have a very substantial quantity of business on hand and are not actually compelled to dump a surplus on an unsympathetic market (I don't use the word "unsympathetic" in an objectionable sense, but for a want of a better synonym) at something better than an out-of-pocket cost; but the time may come when we are not so fortunately situated, when we do want your sympathetic consideration. We of course want all the business at all times that we can get to which we have reasonable title, and we would like to have yours this year, or such amount of it as you think is our fair share, and this letter is written in the hope that if you find you want any from us that we have justified the price quoted and only wished to develop the time and quantity in order that we might give you the best service possible under the circumstances.

# Sand and Gravel Directors, 1924

THE following have been elected to the board of directors of the National Sand and Gravel Association:

District No. 1—A. P. Burke, Atlanta Sand & Supply Co., Atlanta, Ga.

District No. 2—Sam Lawrence, Sam Lawrence & Co., Raleigh, N. C.

District No. 3—David Alexander, Petersburg Sand & Gravel Co., Petersburg, Va.

District No. 4—G. C. Ross, Ohio River Gravel Co., Parkersburg, W. Va.

District No. 5—Hugh Haddow, Jr., Menantico Sand & Gravel Co., Millville, N. J.

District No. 6—Jos. McGaw, Ohio River Sand Co., Pittsburgh, Pa.

District No. 7—E. G. Stallman, Valley Sand & Gravel Corp., Rochester, N. Y.

District No. 8—H. V. Owens, Boonville Sand Corporation, Utica, N. Y.

District No. 9—H. N. Battjes, Grand Rapids Gravel Co., Grand Rapids, Mich.

District No. 10—F. C. Fuller, Portsmouth Sand & Gravel Co., Portsmouth, Ohio.

District No. 11—E. Guy Sutton, Carmichael Gravel Co., Danville, Ill.

District No. 12—J. M. Settle, Ohio River Sand Co., Louisville, Ky.

District No. 13—H. B. Springer, Dixie Sand & Gravel Co., Chattanooga, Tenn.

District No. 14—J. E. Morgan, Victory Gravel Co., Shreveport, La.

District No. 15—W. L. Smith, Memphis Stone and Gravel Co., Memphis, Tenn.

District No. 16—T. E. McGrath, McGrath Sand & Gravel Co., Lincoln, Ill.

District No. 17—F. W. Renwick, Chicago Gravel Co., Chicago, Ill.

District No. 18—W. A. Rowe, Wissota Sand & Gravel Co., Eau Claire, Wis.

District No. 19—J. L. Shiely, J. L. Shiely Co., St. Paul, Minn.

District No. 20—R. C. Fletcher, Flint Crushed Gravel Co., Des Moines, Ia.

District No. 21—H. E. Schellberg, Lyman-Richey Sand Co., Omaha, Neb.

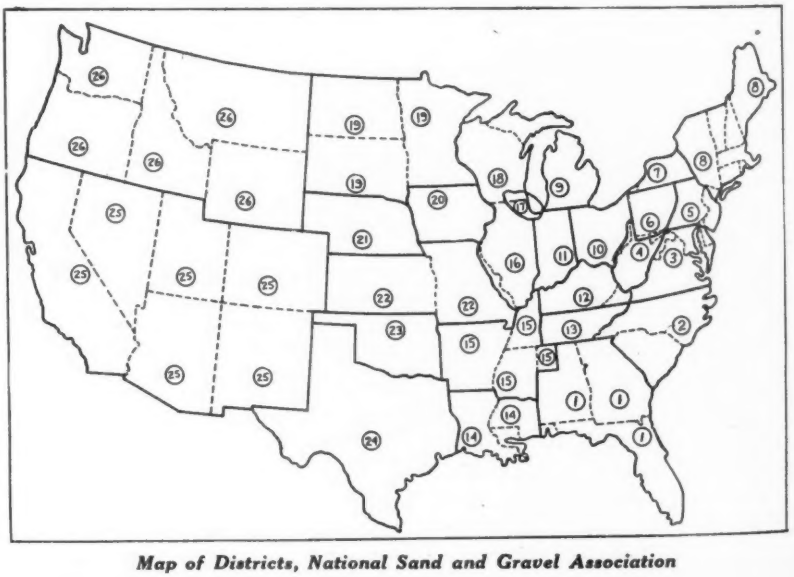
District No. 22—F. W. Peck, Muncie Sand Co., Kansas City, Mo.

District No. 23—J. M. Chandler, Price Sand Company, Tulsa, Okla.

District No. 24—Rhea Miller, J. Fred Smith Gravel Co., Dallas, Texas.

District No. 25—F. W. Erlin, Coast Rock & Gravel Co., San Francisco, Cal.

District No. 26—Geo. Scofield, Savage-Scofield Company, Tacoma, Wash.



***Map of Districts, National Sand and Gravel Association***

# If 1924 Is as Good as 1923, We'll Not Kick

## Big Production, High Wages, Fair Prices and Peace with the Railways Paid Most Rock Products Producers Dividends

By Nathan C. Rockwood
Editor and Manager of Rock Products

EXCEPT in a few more or less isolated localities the rock products industries have just enjoyed one of the most prosperous years in history. It has been a good year for general building work, a good year for highway work, a fair year for railway construction and development, but a rather poor year for those chiefly dependent on the buying power of agricultural communities.

Probably the biggest factor in the prosperity of the country in all industrial lines has been the comparative freedom from strikes and labor troubles. Even labor has been comparatively satisfied with the general trend of things. Another big factor is that for several consecutive months the federal government and the state governments have refrained from unnecessarily interfering with railway operation—leaving railway officials in a position to do a little constructive thinking and a chance to work for their shippers.

### *Production*

Production in all construction materials was appreciably larger in 1923 than in 1922. In the case of lime the increase was probably less than either cement or gypsum. Most of our readers have doubtless followed the monthly statements of the U. S. Geological Survey on the production of portland cement. These indicate that 1923 will be a record year, even as last year was. According to present estimates, the production of portland cement this year will exceed last year's (1922) by 18 to 20 per cent.

The total production of portland cement in 1922 was 114,790,000 bbl.; the total shipments, 117,701,000 bbl. For the first 11 months of 1923 the production has been 126,969,000 bbl. and the shipments 129,143,000 bbl. The production during November was approximately the same as for November of last year. Assuming the same will be true for December, the total production of portland cement in 1923 will figure approximately 136,600,000 bbl., and shipments 136,150,000 bbl.

Reports from sand and gravel and crushed-stone producers show that the production of concrete aggregates increased in about the same ratio as portland cement. In the extreme East, however, there were several localities where there was no increase in production over 1922, and in some instances a decrease.

The gypsum industry shows increased production over 1922 of approximately 20 per cent, which, we presume, represents about the general average of increase in building construction during 1923 over 1922.

### *A Good Building Year in Prospect*

***THE only business we go after is that of building; that is, stucco, terrazzo and cast stone work, and the prospects with us for 1924 are fully up to 1923.***

It is obvious from the returns that the lime industry failed to gain its full share in the general increase in building; and possibly the Geological Survey returns for 1923 will show that the gypsum industry has actually outstripped the lime industry in gross tonnage. In 1922 a little more crude gypsum was produced than lime. But over 1,000,000 tons more lime than calcined gypsum was produced.

### *A West Coast Point of View*

***INSOFAR as this section of the country is concerned, we feel that highway construction will be somewhat less in 1924 than it was this year. There is a possibility that street and alley construction will be about the same as we have experienced in 1923, and prospects are that general building in the Pacific Northwest will show an increase over the current season.***

Agricultural limestone, lime and gypsum seem to have staged a good comeback in spite of the alleged poverty of farmers, but prices were low. The rock phosphate industry showed some slight improvement over 1922, but most producers had "hard sledding" in 1923. Silica sand (including glass sand, foundry sand and refractories) generally were in good demand—better than 1922—and there has been considerable development in this branch of the industry.

### *Developments*

During 1923 there were many changes and improvements in portland cement plants. Five new mills went into operation, two (Lehigh and Phoenix) at Birmingham, Ala., one (Signal Mountain) at Chattanooga, Tenn., one (Pyramid) at Des Moines, Iowa, and one (Sun) at Lime, Ore., capable of producing between 5,000,000 and 6,000,000 bbl. a year in the aggregate.

Work on eight new plants is actually progressing at this time, most of which are scheduled to be in operation not later than next summer. These plants are the Hermitage at Nashville, Tenn.; the Pittsburgh Plate Glass Co., Zanesville, Ohio; the Trinity at Fort Worth, Texas; the Southwestern at Fort Worth, Texas; the Manitowoc at Manitowoc, Wis.; the Pacific near San Francisco, the Yosemite at Merced, Calif., and the South Dakota state plant at Rapid City. The combined capacity of these plants is close to 10,000,000 bbl. Besides these on which work is actually in progress there are more or less definitely developed projects for at least eight other plants.

Extensive improvements have been made at many older plants. At least two old and well-known plants are being changed from dry to wet process—the Glen Falls and the Missouri. All of the new plants, with the exception of the Phoenix at Birmingham, use the wet process. With improvements and additions made the producing capacity of the portland cement industry is still in excess of any consumption to date. While probably between 250,000 and 500,000 bbl. of cement were imported in 1923, this was not because of any real shortage of cement, but because of temporary local shortages and price-cutting by importers.

Waste-heat plant installations are still being made in several of the older plants, including the Alpha plant at Martins Creek, W. Va., the Lehigh plant at Mason City,

Iowa, and the Pennsylvania plant at Bath.

In the lime industry there do not seem to be any spectacular developments. The two stories elsewhere in this issue on the Herzog plant and the Palmer hydrating plant typify progress and the direction of new developments. There is an undercurrent of unrest in the lime industry and a feeling that organized effort on the part of one or more big consolidated companies could do much to cash in on the splendid research work done by the National Lime Association. We look for some big consolidations in the lime industry in the near future and some radical changes in the industry as a manufacturing operation.

Much plant building and development work has been going on in the gypsum industry both in the New York state, the Southwestern fields and on the West Coast. About 60 per cent or more of the production of gypsum is now under the control of three big national organizations having great sales organizations and continuously engaged in nation-wide advertising—the U. S. Gypsum Co., the Beaver Products Companies and the Certainteed Products Co. The Universal Gypsum Co., with headquarters in Chicago, is another fast-growing national organization.

In the case of the crushed-stone and sand and gravel industries, many new plants have been built, but none of any great size or remarkable features. The tendency has perhaps been toward plants of 2000 tons per day capacity or less. Great efforts have been made to further eliminate hand labor, and there have been many improvements made with that end in view.

### *Labor Conditions*

Nearly all operators report fairly satisfactory labor conditions. Wages, quite generally, through most of the season, were from 10 to 15 per cent higher than 1922, but there are few complaints of labor troubles and many statements that labor was considerably more efficient than in times past. The year 1923 has proved that it is *not* by any means bad for the producer to have laborers earning around $25 a week, or more; and it has proved that it *is* a good thing for the general prosperity of the country. Due to the exodus of negro labor from the South to the North, labor conditions in the South were worse than in any other section of the country. Most of the enterprising negroes emigrated, apparently, and the majority of those who didn't weren't worth holding. The Eastern states also suffered more from common labor shortage than the Central West, although wages in some cases were 20 cents per hour more (60 cents in the East, 40 cents in the Central West).

Generally speaking, there has been less labor turnover than in previous years. One reason for this is undoubtedly the fact that operators have either voluntarily increased the length of their operating season, or have been driven to do it to make production or to hold labor in competition with other industries. The bonus system is still popular, especially where a producer has aimed at maximum production.

An excellent illustration of this is the case of a large Northern quarry company, which reports:

"Labor conditions have been good with us. The quantity and quality satisfactory, with a slight upward tendency in wages. However, it has been our practice now for the last seven years to work our men on a bonus system. This bonus applies to all employes in the quarry, on a basis of number of trains consisting of seven 4-yd. cars dumped into the initial breaker. We have three different objectives, depending on whether we are operating one, two or three steam shovels.

"When operating one shovel the objective is 60 trains.

"When operating two shovels the objective is 70 trains.

"When operating three shovels the objective is 80 trains.

"At the completion of the objective there is a straight bonus of 10 per cent on the daily wage, and for every train dumped beyond that the employes receive 1 per cent per train. This has been a most satisfactory arrangement, and during the five or six months when we are extremely busy, our men will average about 15 per cent, that is to say, a man receiving $4 a day will average a bonus of about 60 cents a day."

### *Market Conditions*

In spite of a very large demand for nearly all rock products, there has been pretty keen competition all around, and conditions are all shaping themselves for keener competition next year. Yet there has been little of the cut-throat kind of competition. Producers are getting educated, as possibly consumers are also; at least such reports as this, from an Eastern sand producer, would indicate: "Prices were low. Competition throat-cutting. One competitor has been selling stock to meet deficit, in an admitted effort *to break us.* Another, out of normal shipping radius (who is also so short of water that he is unable to produce a clean gravel, has offered his gravel—knowing it would be rejected—for less than it can be produced; just to disturb the market. And we have made money through it all—by giving *SERVICE* at a reasonable price."

In the case of concrete aggregates the three-cornered competition between crushed stone, gravel and slag is getting very acrimonious in some localities. Of course we shall never see the time when there will be no competition. Indeed, nobody would have it so. We are all more or less sportsmen and we all love a fight. But it can be a fair fight and a clean one, and all will be the happier and profit more.

It is interesting in connection with the recent investigations and court decisions involving portland cement manufacturers that while they have been alleged to have had illegitimate agreements or understandings, apparently no one has successfully or even honestly accused them of charging more than a *fair price.* And whatever the courts may decide, they can not compel intelligent business men to cut each other's throats for the alleged benefit of wrecking a great industry. When all rock products producers conduct their business with the same intelligence it will be a happier day for America.

### *Changes in Specifications*

The year 1923 saw considerable progress made in standardizing specifications of lime

## *From Oklahoma*

***MANY added improvements by railroads are contemplated for next year, as earnings have been fair though not abnormal. In regard to highways, almost every state has good plans for improvements in general, and in specific sections. This state will continue the good roads program in general. The general building field has a most pleasant outlook, expectations for next year comparing very favorably with this year's production.***

## *Too Much Competition in Limestone Specialties*

***IN our business we find that a number of lime plants are putting up mills for fine grinding limestone, without a proper regard to cost, to dispose of their spalls, and are really losing money in this operation, which introduces throat-cutting competition at certain points. However, a number of these people found it did not pay, and so have given it up. We believe that this is more or less of a temporary condition.***

***Quite a number of quarries in our district are putting in plants for making "agstone" and chicken grits. We believe that the increasing demand for agstone will pay, but the same condition will hold in regard to chicken grits that applies to some of those lime plants that are putting in fine grinding apparatus, i.e., that the chicken grit game will be overcrowded very shortly and will introduce very close competition; therefore, we have not gone into this business. We are shortly to install a plant for making "agstone" as the farmers in this district are constantly using more and more. As practically all of our rock runs over 98 per cent calcium carbonate we have very good material for this.***

and gypsum. The requirements for chemical lime are constantly stiffening and are eventually likely to bring about radical improvements in lime manufacturing methods.

In the case of sand, gravel and crushed stone specifications are generally getting tighter, especially in the South and Northwest, where specification requirements have hitherto been rather lax. The work of the Portland Cement Association through such men as Col. H. C. Boyden, who has lectured before engineers and architects throughout the country, along the lines of his article in ROCK PRODUCTS, December 15, 1923, p. 17, is having a tremendous effect in gaining a greater appreciation of the part *good aggregates* play in correct *concrete design.*

***Lengthening the Operating Season***

The tendency toward longer operating seasons is very marked in all lines. Unquestionably the agitation for a longer construction season is taking hold. A great deal of assistance can be given producers, however, if highway contracts are let in the fall or winter, so that spring shipments may be begun at the earliest possible moment instead of May or June as is now the case. It is getting to be general practice with wide-awake sand, gravel and crushed stone producers to accumulate winter stock piles. Generally sand and gravel can be shipped from drained stock piles, even in freezing weather, while, of course, the wet materials would be refused.

While some operators look upon winter operation of quarries as impracticable, one large Canadian producer has something to say on this score that all can read with profit:

"It has been our practice up to two years ago to operate our plant the year around. Our geographical location enables us to operate in a very small way in the winter months when all the other quarry men close down. However, with the installation of a stock pile in which we can carry between 70,000 and 80,000 tons of various sizes, it enables us to close down our quarry proper two or three months in the year. In a climate such as prevails in this section of the province the volume of trade is limited by the weather conditions, so that operating in winter is hazardous. We have always strongly advocated to large consumers, wherever possible, to stock pile raw materials in winter or early spring. Not so much with the idea of lengthening the construction period, but more so as to safeguard against car shortages or unfortunate breakdowns in the quarry."

## Rock Phosphate Prospects

***PROSPECTS for business next year look exceedingly good. The price of cotton is high; and the best way to fight the boll weavil is to force the cotton plant with fertilizers, so, it looks goor for the fertilizer business in 1924.***

## A New Jersey Sand Producer Reports

***THE prospects for next year appear to be good. We do not do very much business in the railroad field so do not expect anything above our average. In the highway field we look for an increase as the highway work carried out in this section last year was away below the average, due mostly to a change in the highway administration last January, which resulted in delays and postponements. The general building field we believe will maintain a demand about equal to that of this year.***

***Transportation Situation***

Nearly every operator has a word of praise for the way in which the railways have taken care of them this year. The graphs of the car service department of the American Railway Association elsewhere in this issue show clearly that the railways have not only handled the biggest freight traffic in their history, but have done so with remarkable efficiency and dispatch.

Statistics of cars of stone, gravel and sand handled—about 2,000,000 cars—in 1923 show the greatest rail movement of these commodities in the history of the industry—yet at 30 tons per car this is only 60,000,000 tons, or probably not over 75,000,000, at most, was moved by rail, whereas the total production of these commodities must certainly have been 150,000,000 to 200,000,000 tons. Of course, barge and truck shipments from commercial plants account for a tontage, perhaps equal to the rail haulage.

There is no question, however, that high freight rates have hindered the movement of commercial aggregates and driven engineers and contractors to the use of inferior materials in many instances. A typical illustration of this comes from a Northwest sand and gravel producer, who writes:

"We believe freight rates are a decided issue in the sand and gravel business. This is especially the case in South Dakota, the rates here being approximately 50 per cent higher than they are in either Iowa or Minnesota. The freight on sand in carload lots for a haul even as short as five miles is greater than our charges for the washed and screened product f.o.b. the cars at our plant. We feel that freight charges have opened up many a wayside pit which would not otherwise be used, and have been responsible for the permitting the use of inferior materials in a great many classes of construction, thereby depriving the producer of his sales, the carriers themselves of a large volume of profitable business and the builder or owner of a class of work to which he is entitled. The subject of freight rates is one that needs attention."

And this from a Canadian quarry man:

"The question of freight rates is a debatable one. Personally, we feel that on our commodity which is a low priced one, and the style of equipment required for transportation is such, that the freight rates are too high. And these rates have been the means, no doubt, of creating numerous local portable crushing plants. While individually their tonnage is not such a big item, yet collectively it is quite a serious factor, not only for the quarrymen, but also for the carrying roads. We know, from a survey made in one section of our province, that the aggregate produced by the portable plants exceeded that produced by all the commercial quarries. Not only does this mean a loss of production to the quarry operators, but also to the railroads. We do not contend that a reduction of freight rates would eliminate all the portable plants, but we do believe it might be the means of closing up 60 or 70 per cent of them. We further believe that the majority of these plants working for counties and townships, that the material has cost them a great deal

## Changing Conditions in the Lime Industry

***CHEMICAL specifications are constantly more severe and a continuation in this direction is expected. Higher grade products are available due to improved manufacturing conditions and specifiers recognizing this development are changing their specifications accordingly.***

***Recognizing the advantage to the industry of such an improvement, we have instituted a complete system of laboratory control on all our manufacturing processes with complete inspection of all materials shipped; no shipments made without the O. K. of the laboratory. We contemplate the continuation of the abandonment of old methods for new, including entire plants in this program.—W. R. Phillips, General Manager, American Lime and Stone Co., Bellefonte, Penn.***

## Keeping Clay Out Quarry During Rainy Season

***WE HAVE TAKEN steps to increase the number of operating days, by the use of tarpaulins in covering our quarry face. Wet weather is practically the only time quarry work cannot be carried on satisfactorily in Texas.***

more, and is of an inferior quality than if purchased from the commercial operators."

In the East the freight-rate issue has taken a rather vicious angle from the fact that producers of certain aggregates are attempting to get preferential rates over competitive materials. This situation is admirably summed up by an Eastern sand and gravel producer who writes:

"We would say that actual freight rates are not an issue to any great extent. We do not believe that a reduction of 5 or 10 cents a ton on all freight rates would increase our sales; but as we see it, the issue is to equalize freight rates and to put the different aggregates such as slag, crushed stone, gravel and sand in the same classification. We believe that sand, gravel, crushed stone and slag should all be on a parity as to car service and rates and that no one aggregate should enjoy any advantage over the others. This is the freight rate issue as we see it."

On the other hand, there are many operators who fear the result of any attempt to make uniform rates for territories of any considerable size. A good example is the following from an Iowa quarry man:

"When considering freight rates, it is the writer's opinion that this question has not yet been settled to the satisfaction of all concerned, especially the railroads. This is very true in our vicinity for the reason that we have been quite successful in forcing railroads to give us uniform rates in line with rates from other quarries in other districts, to what might be called our shipping territory, and while we at the present time feel quite well satisfied with the present rates and new rates proposed to our shiping territory, we believe that the railroads are having in mind to establish fairly uniform rates for coarse aggregates over practically the shipping territory of the United States. If this is going to be done in the near future, it will mean that in quite a large number of territories freight rates on our materials are going to be higher."

It is doubtful, however, if the railways have in mind anything like uniform rates for the United States as a whole, or even uniform rates in the various classification territories. The railways themselves are too real competitors to agree to anything like that. They recognize that freight rates like the prices of stone and gravel are matters of expediency as well as of rule and regulation.

One fair-minded quarry operator in the Chicago district has summed up the case very aptly: "Freight rates are always an issue, but if the rates are uniform, considering location of quarries and no discriminations made to favor, we would not have to register a complaint."

And a West Coast cement manufacturer voices the general consensus of opinion when he states: "We feel that the public is generally satisfied with freight rates on building materials and if curtailed of rates would result in curtailment of railroad service, I do not believe an adjustment to a lower scale would be profitable."

Several producers point out the unfairness of the railways in the handling coal traffic as compared with sand, gravel and stone traffic—shipping of coal on speculation and the cancellation or ignoring of demurrage charges on such coal shipments, which work various hardships on the mineral aggregate industries. The same Iowa quarryman already quoted writes:

"We have had very satisfactory car service the past year and believe that the transportation departments of the railroads are doing all in their power to supply a satisfactory number of cars for all industries; and we also feel that these managers have a very fine grip on the situation, and will not be swayed by any industrial propaganda. We believe that the distribution of the cars and the movement of the same is being quite satisfactorily done by the railroads, but we still feel that there could be a further improvement on more prompt unloading of coal during the season beginning September 1 and ending about March 15 of each year.

"The writer's thought still is that coal should not be loaded at the mines unless orders are on hand for such loadings. This will obligate the purchaser of coal to anticipate his wants for a little time in the future, which means that each and every coal consumer will have a fairly satisfactory amount of coal on hand at all times, and will also mean that coal will not be held at terminals, thereby producing congestion of both empties and loads near the mines, for the reason that all mines will be loading exactly the number of cars for orders on hand, and the same will move promptly to destination.

"It should also be obligatory that coal be unloaded promptly by not only the consumers but also the carriers, who are also consumers, for the reason that the carriers should have coal storage on the ground and in that way unload cars promptly, and receive the benefit of the revenue from such cars, which would otherwise be lost."

### *From a New York State Sand Producer*

***REGARDLESS of high prices, and even with the possibility of increased labor costs, we figure, so far as our territory is concerned, good continuous business will prevail, the coming year.***

***The major portion of this will, no doubt, result from important developments, such as small private homes and improvements; some good sized jobs, in the way of municipal construction or work of private corporations, should also go ahead.***

### *A Western New York Stone Producer*

***PROSPECTS of business for next year are not very promising and on what little there may be we expect keen competition and some price cutting.***

### *From an Iowa Stone Producer*

***AS to predictions for next year we are not so sure as to what the demand may be. We do not think that we will receive any volume whatsoever from the railroads, but the highway requirements ought to be about the same as 1923, with a probability of a decided increase in highway requirements beginning January 1, 1925. Our building requirements have been quite satisfactory during this past year, and I fully believe that the demand for concrete material for building material is going to be quite healthy for several years to come.***

#### *Outlook for 1924*

Every indication both from without and within the rock products industry gives promise of as good or better a year in 1924 as we have had in 1923. The only deterring element is the fact that 1924 is a presidential election year, and election years are supposed to create business uncertainties. However, we seem to be taking our national elections considerably more philosophically than in years gone by, and even the financiers see no cause for alarm.

Next year can be an improvement over this one if the farming communities feel more prosperous, for there is considerable opportunity for more business in the rock phosphate, agricultural lime and limestone branches of the industry.

In the highway building and general building construction fields nearly all the prophets agree business will be good; and there is every prospect that in the railway construction and track improvement field business will be better. Most of the railways were more prosperous in 1923 than they have been for several years and this prosperity is reflected in the big terminal projects already under construction in Chicago and elsewhere. These mean large quantities of steel (which means tonnage of fluxing limestone) as well as big tonnages of concrete aggregates and ballast.

To take care of the business in prospect for next year all our correspondents are slicking up and improving their plants; many are making, or contemplating, extensive additions. Most of them look for constantly keener competition and labor-saving devices of all kinds are being earnestly studied and investigated. A Chicago

quarry man's crisp statement certainly typifies this general feeling:

"Our plan is to add to our equipment, with the hope we shall be able to take care of all the business offered and then some. We do not intend to get the increase by price cutting but by service rendered, and that means a good quality of stone, shipped promptly, and just consideration of our customer, leaning toward him when in doubt."

### *Conclusion*

Before winding up our little say, we can not help expressing our feeling that it behooves every American to have a heartful of gratitude for the kindness of Providence to him and his. While Europe is in turmoil and thousands are on the verge of starvation, and even in old England a million or two men are unemployed, and even stout-hearted John Bull is beginning to lose faith in himself, we in America have enjoyed a year of prosperity almost without parallel—a prosperity based largely on our own industry, our own consumption, our own progressiveness, our own faith in ourselves, our own reliance in our institutions and in human nature.

It only remains for us to keep faith with ourselves and our institutions to see our prosperity prolonged into the indefinite future. Let us beware of calamity howlers and think and believe and talk prosperity and we shall have prosperity.

And in conclusion we want to thank our readers, correspondents and friends for the splendid and whole-hearted way they have responded to our sometimes, perhaps, untimely importunities for their views and editorial assistance. If Rock Products has any merit and if it is really helpful to the industry which we believe it serves, it is because of the helping hand they have extended.

# Missouri Valley Sand and Gravel Producers Meet

## Assurances That 1924 Will Show Improved Business Over 1923

THE fifth annual convention of the Missouri Valley Association of Sand and Gravel Producers was held at the Hotel Muehlbach in Kansas City, December 17 and 18. When Harry E. Moore, the retiring president, in a graceful little speech which opened the convention, explained the purposes for which the organization was formed, and the matters which might properly be discussed at such a meeting, he stressed the matter of good fellowship, and sounded the keynote of the convention.

Routine business took up the first hour and a half of the morning. Mr. Moore first reviewed the industry's progress in the past year and the work of the executive committee in the various meetings which had been held in that time. The report of the treasurer, W. E. Rogers followed, and this showed the association to be in excellent financial condition and with more than $5000 on hand in cash and Liberty bonds. In fact the financial condition is so good that during the past year the executive committee has cut the dues from one cent per ton to half a cent.

This cut in dues, it was explained, was only possible through the practice of some economies. A smaller executive committee will serve in the coming year, which will reduce traveling expenses and other expenses connected with the monthly meetings of the committee. The secretary, W. E. Johnson, will occupy an office with a lesser rental and will dispense with a stenographer, all in order to permit the members to enjoy the benefits of the association at a lower cost.

There are five districts in the field of the association, and reports were made by a representative from each of them. J. M. Chandler, speaking for Oklahoma, said that in his section the industry had had to struggle with a bad political situation, of which the whole country knew, and lower prices for oil and agricultural products on which Oklahoma principally relies for income. But general business conditions in Oklahoma have improved wonderfully of late, so that the prospects are good for the future. O. W. Knight, speaking for the Upper Kaw district, admitted that business had been somewhat dull but noted that it was improving. C. E. Todd, for the Lower Kaw district, which is in Kansas City, reported that business had been practically the same as in previous years and N. C. Dunn told of the losses by the disastrous flood on the Arkansas river, by which many producers were put out of business for a time. Set down in this way the

*Banquet of Missouri Valley Sand and Gravel Association at Hotel Muehlbach, Kansas City, Dec. 18*

record might appear discouraging but every speaker left the impression that conditions were steadily bettering themselves and that 1924 would show a much better record than 1923.

After appointing a nominating committee to select names to present to the convention, to be voted on to fill the offices of the association for the coming year, and also to serve as a committee on amending the constitution, the convention listened to a short talk on the coming national convention and the work of the national association by T. R. Barrows, executive secretary of the national body. The Missouri Valley association holds a peculiar relationship to the national association, in that it is the only organization of the kind that holds its membership as a unit. After Mr. Barrows had spoken, Mr. Moore said that the association expected to attend the St. Louis convention 100 per cent.

E. S. Hanson, International Trade Press, gave a talk on "Side Lines for Sand and Gravel Producers," which was well illustrated with lantern slides of concrete block and brick plants in various parts of the country. He also showed the gradings of the aggregate that might be profitably used for blocks even though it was too fine for general sales as concrete sand.

Luncheon followed. In the afternoon session W. E. Johnson, the secretary, handed around the cost sheets which have been prepared by him from the figures submitted by the members. Put on a percentage basis these figures show that 70.5 per cent of the cost is directly chargeable to operating expense and 29.5 per cent to overhead. Of the direct operating cost, without overhead the proportions are as follows:

| | |
|---|---|
| Labor | 30.9% |
| Fuel | 12.6% |
| Supplies and repairs | 11.4% |
| Depreciation reserve | 28.1% |
| Sundry operating expenses | 17.0% |
| Total | 100.0% |

As is always the case where costs are considered, the question of the amount to be reserved for depreciation and depletion caused a lively discussion. It was closed by John Prince, who explained that it was quite possible for a plant to run for three or four years without apparent loss, but at the end it would be found necessary to make so many improvements and changes that an actual loss would be shown on the books. In other words it would exist by "eating its capital."

Some of the guests were called upon for remarks and Edmund Shaw, of Rock Products, spoke briefly on the public service which the producer gave when he furnished only clean and graded aggregate for concrete. He was followed by Mr. Daily, who indorsed what had been said, and spoke of the "black eye" that reinforced concrete construction had received on account of the failure of the Masonic Temple in Salina, Kan.

Mr. Daily said that his company recognized the necessity of furnishing only material that would insure good concrete and tested the strength of concrete made with the aggregate it produced and specimens had shown as high as 6200 lb. to the square inch in compression. H. E. Schellberg and Thomas Sullivan, both of Omaha, spoke briefly of conditions there.

The second days' session was opened by an address by J. Frank Smith, manager of the Good Roads Association of Greater Kansas City. He distributed a map showing a circle of 100 miles radius around Kansas City and pointed out that this area actually contained more fertile land than the state of Wisconsin.

In the opinion of Mr. Smith, and the association he represents, the matter of road improvement in this district is bound up with the general prosperity of the district. Good roads are needed but agricultural improvement is needed even more. The district is largely a single crop district and has lost much of the fertility of the soil through repeated cropping without returning anything to the soil. With proper farming methods it could easily support twice its present population who would make more money and have a higher standard of living and the good roads would naturally follow. The present production of the district in money is now $600,000,000, about half in agricultural and half in manufactured products. It could easily be doubled. The present population is 24 to the square mile while Illinois has 100.

Mr. Smith rather favored the building of the cheaper types of road at first, saying they were necessary to educate the farm population. Experience has proven that if a community started with gravel roads in a short time they were demanding hard roads (as had been the case around Independence, Mo.), whereas if a beginning was made with an expensive type of road the community would grow disgusted at the cost and throw out all road improvement. As an illustration he mentioned one county in which the board was persuaded to lay three miles of expensive brick road at $50,000 a mile, which was so heavy a burden that the taxpayers had felt compelled to veto any further road improvement.

His association is making an effort to speed up the work of road construction in Missouri so that fifteen to twenty millions would be spent annually.

He mentioned that the district was alive to its needs both for better roads and improved methods of agriculture. Farmers, country merchants and bankers were calling for literature to hand out so that it would take 500,000 copies to fulfill all the requests that had been made.

W. H. K. Bennett of Chicago spoke of the changes in plants that were demanded by the changes in specifications for highway and structural concrete material and showed how engineers were meeting these changes.

The nominating committee brought in its report and the following were elected for the ensuing year:

President, Frank W. Peck; vice-president, W. E. Rogers; treasurer R. J. Stewart, and secretary, W. E. Johnson. The executive committee is: A. E. Fisher, Missouri river district; C. E. Todd from the Lower Kaw, and F. A. Laughead from the Upper Kaw; N. C. Dunn from the Arkansas river and W. S. Dills from Oklahoma.

In the afternoon the members visited plants of the Kaw River Sand Co., the Muncie Sand Co. and the Stewart Sand Co. on the Kaw river.

A banquet was given at Hotel Muehlbach in the evening to which 152 persons, members and guests and their wives sat down. It was an informal affair with no speech making and the only entertainment was that given by the orchestra and songs by Mrs. Peck.

The evening of December 17 the members and friends were the guests of the Kansas City producers at a theater party.

## Reeder Lime and Stone Company Organized

FOR twenty years, Milton E. Reeder, of Muncy, Pa., has been carrying on an extensive business in quarrying, burning and shipping lime throughout Pennsylvania and New York. Now, his son, C. Wilbert, of Muncy, and his three brothers, Robert K., of Muncy, and Charles W. and Frank H., of Hughesville, will enter into the business. A charter has been asked for the Reeder Lime and Stone Company.

The Reeder quarries are located at Chippewa, between Muncy and Hughesville, on the Williamsport and North Branch Railroad. The present operation includes twenty-four kilns. The new corporation will continue the quarrying and burning and add to it the manufacture of ground lime, hydrated lime and crushed stone.

## Big Lake Carrier for Sand

THE LAKE CLEAR, built at Chicago during the war for the Swedish government and later taken over by the United States Shipping Board, will receive repairs and remodeling to the extent of $250,000. The craft is now owned by J. R. Sensibar, president of the Construction Material Co., Chicago, and will be converted into the latest type sand and gravel carrier by a specially designed unloading system which will cost $150,000. The boat will also have twin engines installed.

# Thoughts on Quarry Operation

## Importance of Choosing the Right Explosive

By S. R. Russell, C. E.
Technical Representative, E. I. du Pont de Nemours & Co.

THE year just closing has been, on the whole, a very successful one for the stone industry.

Due to the great amount of road building and construction work that has been done, crushed stone producers have been extremely busy.

The building industry also has been working at high pitch. All this work has made a record demand for stone so that the cement, lime and steel manufacturers were kept going at high pressure. The output in crushed or broken stone has therefore been high. While exact figures are not available the truth of the above assertion is supported by the fact that the consumption of commercial explosives during 1923 has been very great. Probably in excess of 300,000,000 lb. Explosives consumption is always a true indicator of general business prosperity.

The outlook for stone during the coming year bids fair to exceed even that of 1923.

### *Importance of Cost*

It is a human failing that in times of stress and hurry some important factor which enters into the cost of producing anything is often overlooked and neglected. In the production of stone there is nothing more important than the explosive or blasting question. It enters into the cost at the very inception of the work and affects every subsequent operation in the process of manufacture. It is therefore extremely important for quarrymen to give some thought and attention to the subject.

The drilling and blasting deserve the first consideration in operating any quarry, and often it is the most important factor in determining whether or not the quarry can be worked at a profit or a loss.

There are a great many different kinds of explosives manufactured and it is necessary that there should be in order to meet the many varying conditions encountered in nature. Every quarry is a problem in itself, and should be studied by itself. There are, however, some things in regard to explosives which every quarryman should know, and knowing them, he can at least come very near hitting upon the right explosive for his work.

The power of any explosive to perform work depends upon two facts; first that a very small volume of the solid explosive forms a very large volume of gas, and second, that this change from a small to a large volume takes place in an exceedingly short interval of time. Explosives differ both in the volume of gas formed when detonation takes place and in the time required for the change from the solid to the gaseous state, and both these factors affect the power of the explosive to do work. The pressure of the gases formed is of course also influenced by the temperature. One other important factor in an explosive for quarry work is density or weight. In simple words then, strength, quickness and density are of prime importance. There are others, of course, such as stability, sensitiveness, water resisting qualities, etc. important, yet in a minor way.

In quarries where stone is produced for railroad ballast, highways, concrete aggregate, etc., it is desirable to break the stone up as finely as possible in the initial blast. This is also true in quarries producing stone for cement manufacture. Where it is used for lime manufacture, it is not always desirous to shatter it too finely. Therefore in quarries of the first class what one needs is a strong highly shattering explosive to give the best results.

In all large quarry operations the important thing is to keep the steam shovels working to as nearly maximum efficiency as possible. Anything which may cause delays in the operation of the shovels naturally affects the output of the plant and consequently increases the final cost of production per ton of stone. If the stone is shot down in the proper manner the shovels will dig a greater volume and dig it with less effort. If the digging is made easy, it means less wear and tear on equipment, a lower cost of repairs and upkeep for the shovels. These items cannot always be measured immediately but will in the course of the year amount to a great deal and often greatly affect the final cost of operation.

### *Must Keep Shovel Busy*

A blast which figures cheapest on initial loading may be the most expensive in the end because of the greater amount of secondary drilling and blasting necessary, or the stone may be in such large pieces that shovel efficiency is cut down so that the total tonnage per shift will be greatly reduced and hence the ultimate cost of stone on the cars higher than it should be. In any quarry therefore it is essential not only to move out the stone but to break it up in such a manner that it can be handled with the equipment in use.

I believe there has been a tendency recently on the part of some operators to use the lighter type of explosive on the ground of economy. Except in a few isolated cases, I believe this is a mistake. Where maximum shattering is desired it is necessary to use an explosive of high strength and quickness and relatively high density for best results. This is especially so in quarries where limestone is crushed for general commercial uses other than for lime or flux purposes. It is especially true in the harder rocks such as granites and traps. Too much attention is often given to the first cost of the explosive, forgetting the after costs and all the other subsequent operations. I could cite many instances where great improvements have been made by using a high density explosive like gelatin in place of a lighter type dynamite and very noticeable increase in output gained, and hence lower cost per ton.

### *Advantage of Gelatin Dynamite*

It has been proven that gelatin dynamite when under confinement—that is, in a bore hole—is just as quick or quicker than the corresponding grade of straight nitroglycerin dynamite. Heretofore nothing in the way of commercial explosive has been known that is quicker than straight nitroglycerin type. Gelatin also possesses the characteristic of high density which permits a better concentration of the explosive force in the bore hole, especially in the bottoms where this is usually required. Gelatin dynamites are besides considerably safer to handle and load than straight dynamites. They possess all the good features of a straight and in addition other characteristics such as density, high water resistance, which a straight does not possess. In view of the number of very serious accidents occasioned by the use of high percentage straight dynamites, it is advisable and safer to use a corresponding strength of gelatin, especially for use in deep well drill holes.

Therefore any quarry owner who is producing crushed stone for commercial

purposes will do well to remember that best efficiency can be gotten with an explosive which is quick; one which produces the greatest volume of gas at highest pressure, and one which is relatively dense.

There are, of course, quarries where the lighter or low density explosives are best adapted. This article is written however with the harder rock quarries in mind.

### *Study Drilling*

The drilling of holes must precede the blasting and the drilling must be studied with care. I find that there is a tendency to space the holes too far apart in well-drill work. Often poor results are due to incorrectly spaced holes and because they are not drilled far enough below grade. In well drill work there is a limit to the distance apart at which holes should be set to obtain best results. It is better to err in drilling holes farther back than too far apart. Often the additional face burden can be taken care of by using a higher strength explosive. This substitution, however, will not always take care of a condition where holes are set too far apart. The degree of fragmentation obtained depends greatly on the distance apart between the holes. It is absolutely necessary and most important that the fragmentation should be so that the shovels can handle the material easily.

This limit in spacing holes depends upon the intersection of the lines of force formed by drawing a right angle from the center of the hole to the face. If the intersection of these lines is between the face and the line of holes, the fragmentation will be better than if the intersection is beyond the face, or if the intersection is about midway betwen face and line of holes it is better than if it is near the edge of the face. It is a better plan to set holes farther back in order to compensate for the crowding. For instance if a spacing of 20x20 ft. is carried this will produce 400 cu. ft. of stone per foot of hole. Better breaking would be had if holes were set 16 ft. apart and 25 ft. back, in which case also 400 cu. ft. of stone per drill foot would be gained, so that the drilling cost would be no higher. It is often an advantage to increase the face or breast burden. By so doing a greater resistance is offered which oftentimes gives the explosive time to shatter through the mass of rock.

One can conceive of a case where the distance between the holes and face was so slight that the stone would be thrown a great distance but not broken up well. The time element here is extremely short in any event but there is some *time;* and it may be sufficient to permit the full effect of the explosive force to penetrate or break up the rock. The buffer system of blasting is used to take advantage of this principle. Another important feature in drilling is to make sure that holes are put down to sufficient depth below the floor grade. The grades should be established by an engineer's level and stakes should be set at regular intervals around the quarry face for guidance of the driller. If holes are drilled to right depth and proper explosive used, remembering density in this connection, rarely will trouble be had with hard bottom.

In holes under 50 ft. in height, 3 to 5 ft. below is sufficient in most quarries. Above 50 ft., at least 5 ft. sub drilling should be carried and in very deep holes from 100 to 150 ft., perhaps 8 ft. is better.

The drilling question deserves the very closest attention at all times. As a general proposition I would suggest the following spacing and sub-drilling for various heights of quarry face:

| Height of face | Distance apart | Distance back | Sub-drilling |
|---|---|---|---|
| 30 ft. | 12 ft. | 14 ft. | 3 ft. |
| 40 ft. | 12 ft. | 16-18 ft. | 4 ft. |
| 60 ft. | 15 ft. | 20 ft. | 5 ft. |
| 75 ft. | 16 ft. | 22 ft. | 5 ft. |
| 100 ft. | 20 ft. | 25 ft. | 5 ft. |
| 125 ft. | 20 ft. | 28 ft. | 7 ft. |
| 150 ft. | 20 ft. | 30 ft. | 8 ft. |

A closer attention to drilling and blasting on the part of every quarryman will be most profitable. It is not the first cost of the explosive that counts. It is the final cost on the cars.

# The Talc Industry in 1923

## Turning Point Has Been Reached but Needs Research and Development Work

By Raymond B. Ladoo
General Manager, Southern Minerals Corp., Cleveland, Tenn.

FROM an economic standpoint, the talc industry in the United States should be divided into three sections, based upon the three main types of product made. From a quantitative standpoint, the most important section includes the foliated, massive and so-called "grit" talcs of Vermont, Massachusetts, New York (Natural Bridge), Pennsylvania, New Jersey, Virginia, Georgia, North Carolina and Maryland. The type next in importance includes the hard or so-called "fibrous" talcs of the Gouverneur district of New York. The third, and, quantitatively, least important type, is found in the high grade white talcs, used chiefly for toilet purposes and produced almost solely in California. These three groups are quite distinct and are almost non-competitive, one with another.

Of the talcs in the first group, which are similar in quality and sold competitively, Vermont talc is the type and by far the most important. During the past few years the Vermont talc industry has suffered severely from unreasonably low prices, due to disastrous price cutting and to overproduction. This situation of course adversely influenced the industry in the other states of this group. During 1923 the decline in prices probably reached its limit, with roofing grade talc selling below the cost of production for most companies, and other grades in only slightly better position.

During the first six months of 1923 sales of Vermont talc proceeded at a fair rate, but fell off considerably during the summer. From the latter part of September to the end of the year sales increased again to a fair volume. Probably the 1923 production did not equal that of 1922 either in volume or value. Prices during the year were generally lower than in 1922, but toward the end of the year there was a general trend toward the higher price levels so urgently needed. The outlook for 1924 demand seems rather better than prevailed in 1923.

There were practically no developments in the Vermont district in either mines or mills. Rather the reverse has been true. One prominent producer states: "Property development has not kept pace with production, and the tendency has been to allow both mines and mills to depreciate without proper upkeep. This is principally due to the fact that manufacturers were suffering losses on account of the low prices and did not care to spend the money to keep the business in the proper repair and development." It is evident that if the industry is to continue on a sound basis, prices must rise to a point which will permit of adequate development of mines and allow a fair profit.

One important recent development in the Vermont district should be noted. The Magnesia Talc Co. of Waterbury, for some years a producer of talc crayons, has developed a considerable tonnage of high grade massive crayon stock, and has greatly increased its production of crayons. Georgia production has declined, and Vermont is now by far the largest producer.

Less complete information is available on the fibrous talc district of New York, but it appears that the industry there is in a much more healthy condition. There are now but two talc companies operating in St. Lawrence county. One of these companies is very progressive and reports considerable progress during 1923. A new mill was completed, and plans are under way to double the capacity of this new mill within a few months. A new property about one mile east of Little York was prospected to a vertical depth of about 62 ft., revealing a vein of high grade talc about 16 ft. wide.

Prices on New York fibrous talc remained about the same as in 1922. Production probably was a little larger than that of the previous year, and it is believed that 1924 production will be still larger, although the decrease in business of one company may offset the increase of the other.

Talc production in North Carolina, Georgia and Maryland has been adversely affected by low prices and has declined considerably. In 1922, these states, together with Pennsylvania and New Jersey, accounted for only about 7 per cent of the total quantities of talc and soapstone mined in this country, and the production probably declined in 1923.

In the high grade talc districts of California, the 1923 production and prices were probably about the same as those of 1922. The two principal producers have maintained their high standards of quality and have developed additional reserves. The tariff protection afforded by the present schedule is so slight as to be almost negligible and California producers find competition difficult, with imported toilet grade talcs. Despite this handicap and those imposed by irresponsible mushroom Western talc ventures, the industry is still managing to hold its own.

It is evident, with the possible exception of one or two producers of New York fibrous talc, that the talc industry is not in a healthy condition. In order that the industry may live and prosper it needs: (1) higher prices, (2) few producers, (3) larger producing companies, (4) systematic research to develop new uses for talc and expand present uses. If the first three needs are cared for, funds and facilities for research can be had.

# Ohio Producers Win Rate Case

## The 40 Per Cent Reduction on Sand, Gravel and Crushed Stone Will Stay

A TELEGRAM dated December 27 received from Guy C. Baker, secretary of the Ohio Sand and Gravel Producers Association, and vice-president of the Greenville Gravel Co., Greenville, Ohio, reads:

***Interstate Commerce Commission has upheld Ohio Public Service Commission and finds no discrimination against interstate commerce through state-made rates. The decision is a victory for the Ohio Sand and Gravel Producers Association, marking the end of a two-years fight.***

This famous rate case dates back to the time when the Ohio Public Service Commission was won over by the arguments of sand, gravel, and crushed stone producers and ordered off the 40 per cent increase of 1920 in the intrastate freight rates on these commodities as unnecessary and a hindrance to their use and movement.

The railways appealed from the state decision to the Interstate Commerce Commission on the ground that the 40 per cent difference in rates created a condition discriminatory to the interstate movement of these commodities. In the meantime the National Sand and Gravel Association pushed a national case before the Interstate Commerce Commission for a general reduction of rates on sand, gravel, and crushed stone. This case was decided about a year ago against any general reduction. The commission, last July, refused to reopen the case on the petition of the National Association.

The decision was looked upon as a severe blow to Ohio producers for it was good ammunition for the railways' side of their controversy. The Ohio case was heard before an examiner of the Interstate Commerce Commission and his report was in favor of the railways and recommended that the 40 per cent increase be restored.

Now, however, the matter has been finally decided by the Interstate Commerce Commission in favor of the producers on the grounds that these short-haul commodities do not enter into interstate commerce except in special cases; and apparently the decision is based on the sound ground that the state commissions, being on the job and capable of making a more intensive study of local conditions, are in a better position to determine fair rates than the national body. If this is the case (we have not yet seen a copy of the decision) it certainly is a distinct victory for the entire sand, gravel, and crushed stone industry of the United States, and the Ohio Sand and Gravel Producers Association deserves a gold medal for its long, hard, uphill fight.

***Three Big Events Coming Soon!***

***ANNUAL CONVENTION OF THE NATIONAL AGSTONE ASSOCIATION***

***William Penn Hotel***

***Pittsburgh, Penn., January 15-16***

***A. P. SANDLES, Secretary***
***405 Hartman Building***
***Columbus, Ohio***

***ANNUAL CONVENTION OF THE NATIONAL CRUSHED STONE ASSOCIATION***

***Statler Hotel***
***St. Louis, Mo.***

***January 21, 22 and 23***

***A. P. SANDLES, Secretary***
***405 Hartman Building***
***Columbus, Ohio***

***ANNUAL CONVENTION OF THE NATIONAL SAND AND GRAVEL ASSOCIATION***

***Chase Hotel***
***St. Louis, Mo.***

***January 22, 23***

***T. R. BARROWS, Secretary***
***903 Munsey Building***
***Washington, D. C.***

***ANNUAL CONVENTION OF THE NATIONAL SLATE ASSOCIATION***

***Commodore Hotel***

***New York City, January 21, 22, 23***

***W. S. HAYS, Secretary***
***757 Drexel Building***
***Philadelphia, Penn.***

## New Michigan Gravel Plant

THE J. C. STEWART CONSTRUCTION CO.'S new plant near Owasso, Mich., is rapidly approaching completion. It will work the gravel found on the Van Patten farm, which is of excellent quality and about 75 per cent of the deposit. Steel bins will be a feature of the construction. A six-inch centrifugal pump is being installed to bring water for washing from the Maple river and a steam shovel is at work stripping the deposit. It is not expected to begin washing operations until spring.

*One of the plants of the Union Rock Co., Los Angeles, Calif., and a trainload of the product on the Southern Pacific railway*

# Advertising for a Specific Purpose

## To Sell Clean, Washed Material BY THE TON

THE Union Rock Co., Los Angeles, Calif., producers of sand, gravel and crushed stone to the amount of 15,000 tons daily, have recently carried on two advertising campaigns in the local daily press, which are of much interest to the industry at large because they give an excellent illustration of advertisements with a punch.

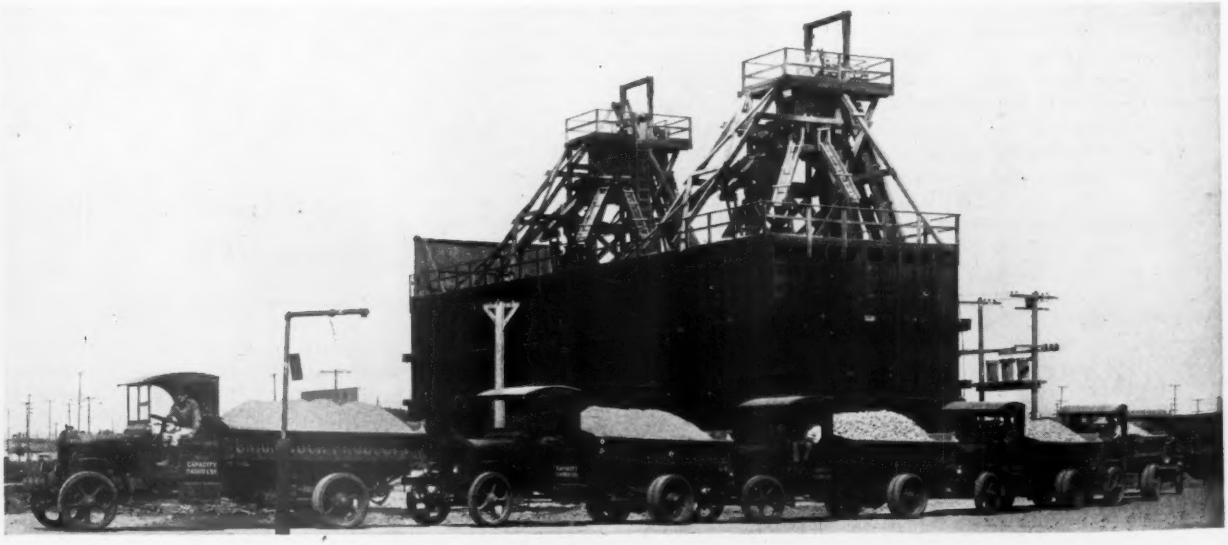
The first of these campaigns was directed to purchasers of sand and gravel for the purpose of selling them on *ton* shipments instead of the *cubic yard*. The same problem bothers producers in nearly all the West Coast States. It has been satisfactorily solved in a few Eastern cities, but not generally.

A cubic yard is a very elastic measure as ordinarily put into practice. While the contractor or engineer may compute his requirements in cubic yards, there is no more necessity of measuring shipments by the cubic yard than there is in selling coal by the cubic yard. Cubic yards of any given material may be readily converted to the average equivalent in pounds or tons, and then all cubic yards are alike. Otherwise cubic yards are whatever the contractor rates his trucks for, or whatever unscrupulous competition may make them.

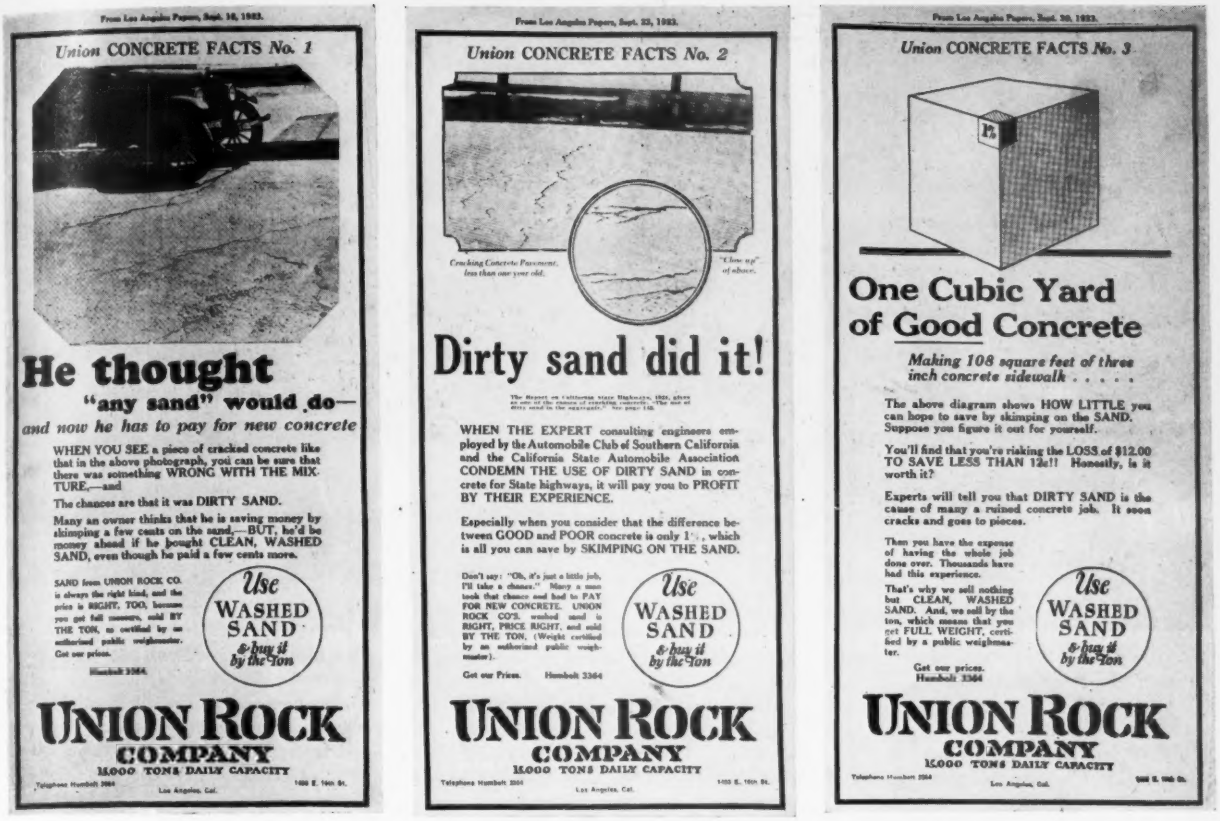
Herewith are three sample advertisements designed to impress purchasers and the public with the desirability of ton measurements. These are the more interesting because the Union Rock Co. was playing more or less of a lone hand with one of those propositions that are very difficult to put over without the co-operation of other producers.

The other series of advertisements is equally interesting as an example of the kind of advertising that is really helpful to the industry as a whole. One can not by direct advertising increase the consumption of a staple commodity like sand or gravel. About so much of it is bound to be used, provided a certain amount of construction work is done. One might advertise to encourage construction work, or to develop new uses for sand; but such advertising is indirect, and with so common a material as sand or gravel would probably seldom pay.

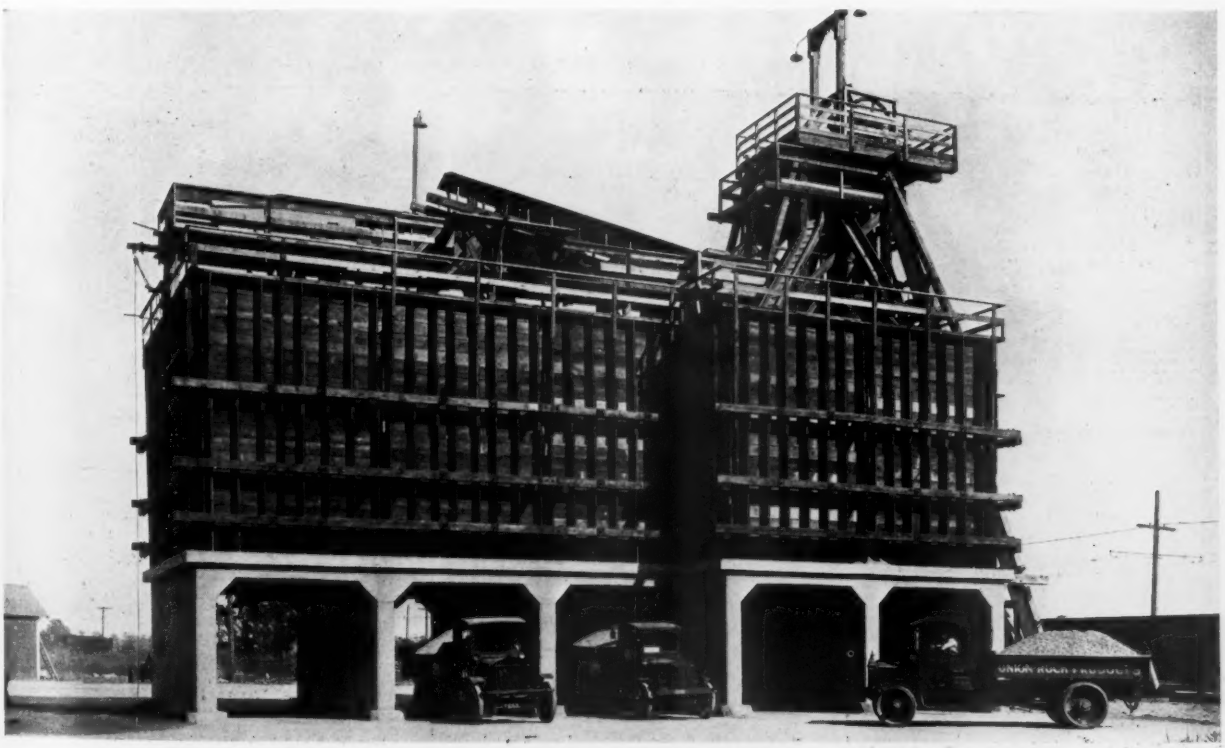
But where a producer is one of a small minority producing *washed* material in his district, he can greatly increase his sales by properly directed advertising to create a demand for washed material in competition



*Some of one of the new city service bins of the Union Rock Co., Los Angeles*


From Los Angeles Papers, Sept. 16, 1923.
Union CONCRETE FACTS No. 1
He thought
"any sand" would do—
and now he has to pay for new concrete
WHEN YOU SEE a piece of cracked concrete like that in the above photograph, you can be sure that there was something WRONG WITH THE MIXTURE,—and
The chances are that it was DIRTY SAND.
Many an owner thinks that he is saving money by skimping a few cents on the sand,—BUT, he'd be money ahead if he bought CLEAN, WASHED SAND, even though he paid a few cents more.
SAND from UNION ROCK CO. is always the right kind, and the price is RIGHT, TOO, because you get full measure, sold BY THE TON, as certified by an authorized public weighmaster. Get our prices.
Humbolt 3364.
Use WASHED SAND & buy it by the Ton
UNION ROCK COMPANY
1,000 TONS DAILY CAPACITY
Telephone Humbolt 3364 Los Angeles, Cal. 1400 E. 16th St.
From Los Angeles Papers, Sept. 23, 1923.
Union CONCRETE FACTS No. 2
Cracking Concrete Pavement, less than one year old.
"Close up" of above.
Dirty sand did it!
The Report on California State Highways, 1924, gives as one of the causes of cracking concrete, "The use of dirty sand in the aggregate." See page 148.
WHEN THE EXPERT consulting engineers employed by the Automobile Club of Southern California and the California State Automobile Association CONDEMN THE USE OF DIRTY SAND in concrete for State highways, it will pay you to PROFIT BY THEIR EXPERIENCE.
Especially when you consider that the difference between GOOD and POOR concrete is only 1¢, which is all you can save by SKIMPING ON THE SAND.
Don't say: "Oh, it's just a little job, I'll take a chance." Many a man took that chance and had to PAY FOR NEW CONCRETE. UNION ROCK CO'S. washed sand is RIGHT, PRICE RIGHT, and sold BY THE TON. (Weight certified by an authorized public weighmaster).
Get our Prices. Humbolt 3364
Use WASHED SAND & buy it by the Ton
UNION ROCK COMPANY
1,000 TONS DAILY CAPACITY
Telephone Humbolt 3364 Los Angeles, Cal. 1400 E. 16th St.
From Los Angeles Papers, Sept. 30, 1923.
Union CONCRETE FACTS No. 3
12
One Cubic Yard of Good Concrete
Making 108 square feet of three inch concrete sidewalk . . . . .
The above diagram shows HOW LITTLE you can hope to save by skimping on the SAND. Suppose you figure it out for yourself.
You'll find that you're risking the LOSS of $12.00 TO SAVE LESS THAN 12¢!! Honestly, is it worth it?
Experts will tell you that DIRTY SAND is the cause of many a ruined concrete job. It soon cracks and goes to pieces.
Then you have the expense of having the whole job done over. Thousands have had this experience.
That's why we sell nothing but CLEAN, WASHED SAND. And, we sell by the ton, which means that you get FULL WEIGHT, certified by a public weighmaster.
Get our prices. Humbolt 3364
Use WASHED SAND & buy it by the Ton
UNION ROCK COMPANY
1,000 TONS DAILY CAPACITY
Telephone Humbolt 3364 Los Angeles, Cal. 1400 E. 16th St.

***Series of three ads designed to sell washed sand and gravel—actual size of ads 6x12¾ in.***



***One of the newest city service bins, or bunkers, costing in the neighborhood of $75,000 each. The company has about ten of these***

*Truck scales at every service bin*

*Sample of trucks used for city sales*

with unwashed. The three advertisements herewith show such use of newspaper space.

While the issue here was washed or unwashed material, there are many localities where all material is washed and this advertising would be without any particular point. In such a case the producer must look for some other distinctive point. Possibly it is a more nearly perfect "fineness modulus" for strength and economy of a concrete mixture than competitors have; perhaps a material of greater fire-resisting qualities than the average; perhaps a more uniform run-of-plant—any one of these may furnish a selling argument which could be featured to identify the advertisers' material with desirable wants on the part of the purchaser. Then, of course, there is always the *service* feature, which a reputable commercial producer can use to advantage.

Summarizing, these advertisements are a good example of how to advertise for results. To advertise sand as sand, gravel as gravel, crushed stone as crushed stone is not going to bring results in selling a staple commodity. Where one can not have a brand name to popularize—and this is seldom possible in the case of a material like sand—advertising must have some direct objective other than a general desire to sell.

The president of the Union Rock Co. is George Rogers, a contractor of many years experience and an engineering graduate of Cornell University. Associated with him are several younger brothers. The manager of the sales department, responsible for the "copy" shown, is Walter Moore, Jr.

FROM LOS ANGELES TIMES, JUNE 24, 1923

FROM LOS ANGELES TIMES, JUNE 24, 1923

FROM LOS ANGELES TIMES, JULY 8, 1923

Buy Rock by the Ton!
And Get What You're Paying For
Certified!
By a Public Weigh Master
The Business-like Way to Buy Rock, Sand and Gravel
UNION ROCK
COMPANY
1000 TONS DAILY CAPACITY

*A series of three ads designed to sell sand, gravel and crushed stone by the ton. Actual size 8¼x14 in.*

# The Year 1923 as Seen by Equipment Manufacturers

## Many Developments in Labor-Saving Machinery—Notable Installations Made

AMERICAN MACHINERY and equipment manufacturers have shown their native ability to meet the new conditions and the new demands upon them for the production of rock products with less labor and at lower costs. Indeed the rock products industries are fortunate in working in such close harmony with the people who make machinery and equipment, that their mutual dependence on one another is readily recognized; and much of the pioneer engineering in the field has been done, and is being done, by the manufacturers of machinery, equipment and materials used by producers of rock products.

### Drilling and Blasting

By M. B. Garber
The Sanderson Cyclone Drill Co., Orrville, Ohio

In reviewing the year's business in big blast hole drilling for quarry work, there has not been anything very unusual or new in the way of developments for what may be termed the average quarry but there have been some important steps forward in the handling of hard rock propositions such as granite, quartzite and trap rock.

There is a growing tendency on the part of operators of extremely hard rock quarries towards the use of well drills instead of tunnelling or snake holing and as the problems of such quarries from the drilling standpoint are very difficult, we have been led to the bringing out of a still heavier blast hole drill than has ever before been used for quarry work. This machine has been designated as the No. 14 "Super Cyclone" drill. It is of the same general design and construction as the No. 14 Standard drill which has been serving the quarry industry for fourteen years.

The No. 14 Super drill is built to handle a string of drilling tools weighing a ton or more. Such drilling tools usually consist of a drill stem 5 in. in diameter by 20 ft. long and a drill bit for 6½-in. to 8-in. holes and very often a set of drilling jars, a tool that is not required for the average quarry work. The main object of such a blast hole equipment is to have a hole of sufficient diameter to permit the taking care of emergencies that will arise in drilling holes in rocks as treacherous as trap rock, quartzite and granite which are usually full of seams and crevices running in almost any direction.

Other advantages of the larger drilling tools and holes are: The additional weight increases to a certain degree the drilling speed although this is offset somewhat due to the larger diameter of holes drilled. The larger drilling tools may be equipped with heavier taper joints which resist breakage when the drilling tools are caught in crevices, fissures or crooked holes. Third, the larger diameter holes permit somewhat wider spacing and a greater concentration of explosives at desired points.

The No. 14 Super Cyclone drill is not what might be termed a regular stock job but is built only on special occasions where investigation of the quarry conditions shows that this equipment is needed in order to handle some difficult problem. One of these drills is now being used in eastern Pennsylvania in a trap rock quarry of a large stone company. This quarry has always been considered without the scope of well drill operation. Fifteen of these drills were shipped to a large mining company in South America who had a peculiar drilling problem.

In looking over the year of 1923 we find that the new drilling equipment sold to quarries has been divided about half and half between new propositions and old users of our equipment.

### Improving Drill Steel to Increase Quarry Output

By A. D. Walter
Colonial Steel Co., Pittsburgh, Penn.

Where tool steel is used for cutting purposes it was shown years ago that certain alloys, added to the tool steel in the making, greatly improved its cutting speed and endurance. Chief among these alloys is vanadium.

Vanadium was introduced into steel used for making tools for metal cutting, and for thin-edged tools that must withstand great shock and stress. One of the pioneers in this field of tool steel making is the Colonial Steel Co., and for more than 20 years their large mill at Monaca, Penn., has been devoted solely to the production of fine tool steels.

Colonial No. 7, their vanadium tool steel, early demonstrated itself a success in metal cutting, and is in reality the father of their "Red Star" vanadium drill steel, a steel that is today repeating in rock drilling the success of their vanadium steel in metal cutting.

Vanadium is a master alloy. It makes steel denser, tougher, stronger. In drill steel it makes a bit that holds its edge and its gauge longer, cuts faster and materially reduces drill bit breakage.

First this steel was tried out in some of the metal mines where the rock was exceptionally hard and drill bit breakage ran high. Its success from the very start showed great promise, and every promise has been more than fulfilled. Today vanadium has been standardized upon and is used exclusively by some of the largest mine properties in the country.

Its double advantage of faster cutting and reduced breakage have made vanadium the ideal drill steel for quarrying. These features make it a profit-producer and an economy in one. It is as easily hardened and tempered as ordinary straight carbon drill steel, and holds its edge and is gauge longer requiring far less re-sharpening.

### All Steel Blast Hole Drill

By W. J. Walsh
Armstrong Manufacturing Co., Waterloo, Iowa

Notable among the recent improvements that have been made in quarry machinery and equipment should be mentioned the all-steel blast hole drill, which was recently put on the market by the Armstrong Manufacturing Co., Waterloo, Iowa.

This company has a long successful record as manufacturers of drilling machinery and their new all-steel machine is the result of many years of constant study and improvement. No one will question the practicability of steel construction in a machine of this kind, as it means longer life, fewer breakdowns, less repair expense, lower operating costs, elimination of fire risks, and a bigger resale value in the end. Both the entire frame and derrick are made of channel steel beams and angles, with every piece hot riveted in position. This construction gives the very maximum of strength, with minimum weight, and it will not warp, shrink, burn, rot or wear out under the hardest operating conditions. (A model of this drill will be shown at N. C. S. A. convention at St. Louis in January.)

One of the main outstanding features is the efficient drilling motion employed. This is obtained by direct drive from a steel crank on band wheel shaft, giving a quick, snappy stroke and is controlled by a simple compensating clutch which is made integral with the band wheel, and does away entirely with gears, sprockets, chains, etc. so productive of trouble and expensive delays. The spudding beam also working in perfect harmony with the drop of the tools eliminates all whipping and snapping of the cable in the air, thereby reducing the wear on cable to a minimum.

The company builds both traction and non-traction models, to be operated by either a gasoline engine or electric motor. The gasoline engine is of the 4-cylinder type, which gives the advantage of more power, less weight, less vibration, easy starting, wide range of speed control, and low consumption of fuel and water.

### Augers and Drills

By John J. Roberts
Howells Mining Drill Co., Plymouth, Pa.

In the drilling and blasting field, in gypsum and similar materials, it is essential and important that the drillers secure, if satisfactory results are to be obtained, drills and augers, that will give to the owner and user maximum service, with few calls to the blacksmith and machine shops.

The Howells Mining Drill Co. of Plymouth, Penn., have been actively engaged for the past forty-five years in the manufacture of rotary auger type drills, operated by electricity, air and hand power. These drills are sent all over the

whole world, for the drilling not only of coal and rock, but for drilling materials, like gypsum, plaster, fireclay, limestone, talc and salt.

Augers, and the manner of sharpening same, are exceedingly important to the driller. To do good work, one must have good tools, and, if a cheap grade article is used, it seldom is out of the repair shop, which does without question increase the operating cost, and has a tendency to fasten a doubt in the mind of the operator as to whether the next hole can be drilled without the auger being resharpened.

First and foremost in the line of drills operated by electricity is the "Spry" Type S and Type D, which when operated at direct drive with a 6T feed bar, is capable of drilling at the rate of 8 ft. per minute. Of course, in drilling materials that are fairly hard, a finer thread bar is used, and if the material is very hard, then they have an attachment, which enables the operator to reduce the drilling speed in a minute, which is done by inverting the main gear wheel, which permits the auger to penetrate more slowly, without injuring the sharpening of the auger.

They also have other drills, should an electric drill not be desired, and we believe that judging from their past records that the gypsum and fireclay companies are more and more becoming users of Howells augers and drills.

We are informed that the business obtained during 1923 surpasses all previous years' business, a goodly portion of which was shipped to Japan, France, India, Philippine Islands, and Central America.

## New Type Air Drills

By J. H. East, Jr.
The Denver Rock Drill Mfg. Co., Denver, Colo.

The ever increasing demands of the mining industry for greater economy extends to every phase of operation including a reduction in the drilling time and lower maintenance charges. To this end the Denver Rock Drill Manufacturing Co. of Denver, Colo., has contributed notably during the year.

The successful pioneer, Model 21 "Turbro" Waugh drill with its independently controlled air-turbine rotation, demonstrated its superiority over drills of the rifle-bar type. But now the mines and quarries require even more. After much experimental and field work, the Model 31 Turbro Waugh drill has been perfected. This drill strikes hard, has a powerful rotation, and seems to meet the requirements of the industry in every particular. Careful design and the use of the best materials in construction made possible the reduction in weight of the new drill while still maintaining the high standards of all Waugh products. Model 31 Turbro Waugh drill is a one-man drill weighing only 146 lbs. when fully equipped for drifting. It rides low in the mounting, making it easy to change steel without swinging the drill. The new drill is well suited for drilling all classes of rock, and is especially efficient in loose or fitchery ground where a strong, positive rotation is needed.

Model 34 Turbro Waugh drill has been developed along the same general lines as Model 31 Turbro. It is designed for use in extremely heavy work where the rock is exceptionally hard or where the unusually long drill steel is used. The hammer strikes a very heavy blow, making this drill particularly desirable in driving large tunnels and in quarry bench mining where deeper holes of larger than the usual diameter are needed.

Model 300 Turbro Waughoist has been further improved during the year. This is a double-drum, compressed air hoist for scraper mining, developing 10 h.p. when operated at a line pressure of 50 lbs. at the hoist. Its field has been enlarged by the addition of positive brakes which permits its use in handling loads in raises or winzes. The hoist has an average rope speed of 178 ft. per minute when the rope pull is 2000 lbs. and the air pressure 50 lbs. at the hoist. Higher horsepower and greater rope speed are of course developed when higher air pressures are used.

### *Drill Tempering*

The Waugh Comparascope has been developed and placed on the market in an effort to assist the mining industry by eliminating much of the drill steel trouble caused by forging and tempering at improper temperatures. The Waugh Comparascope is an electrical device showing the range of colors at temperatures from 1000 deg. F. to 1800 deg. F. By comparing the heated drill steel with the color shown on the Comparascope the blacksmith or tool dresser can readily check the proper temperature for either tempering or forging. The device is simple to operate, consisting merely of "plugging in" opposite the heat desired. The correct temperature for the various heat treating operations and for different grades of steel are plainly indicated on the body of the Comparascope. The application of this device is not confined to drill steel alone. It may be used effectively in any industry desiring temperature controls within the range specified.

## Non-Freezing Explosive

By W. G. Zindell
Atlas Powder Co., Wilmington, Del.

It is a well-known fact that explosives of the dynamite class freeze at comparatively mild temperature. Therefore, the use of such explosives in winter has always been a problem—a problem entailing inconvenience, extra equipment in the way of thawing facilities and the loss of considerable time and labor.

For years explosive manufacturers labored and experimented to develop an explosive that would not freeze. But, while a number of so-called non-freezing explosives were produced, none proved equal to dynamite in its various other properties until the development of "Ammite"—a non-freezing explosive that possesses all the advantages of dynamite yet will not freeze no matter how low the temperature may go.

The manufacturers inform us that during the last two years millions of pounds of this comparatively new Atlas product have been used for various kinds of blasting work. In strength, velocity, stability and water resisting qualities, it is practically the equal of dynamite. While for many kinds of other work, such as quarrying, engineering, road building and contracting, it has advantages over dynamite, in that it does more work pound for pound when the proper grade of Ammite is used for any particular class of blasting work.

More than that, many large users of Ammite have found it an excellent explosive as an all-year round standby—one that may be used in summer as well as in winter because it keeps indefinitely and will not deteriorate when stored under proper storage conditions.

## Improvements in Air Compressors

By S. B. King
Sullivan Machinery Co., Chicago, Ill.

An improved portable gasoline engine-driven air compressor, class W[illegible]11, has just been put on the market by the Sullivan Machinery Co. In redesigning this gasoline-engine-driven model, the capacity of the compressor has been increased to 170 cu. ft. displacement per minute. This enables users to operate two rotator hammer drills at 100 lb. pressure simultaneously for holes to 14 ft. in depth if desired.

A new transmission has been provided, consisting of a simple and substantial gear reduction, to cut down the engine speed to that suitable for compressor operation. The Buda YTU four-cycle, four-cylinder engine is retained, on account of its simplicity, and reliable operating characteristics; 81 hp. is required to operate the compressor at full speed and pressure, and this leaves substantial margin of power in the engine.

The truck body is exceedingly substantial and equipped with a steel canopy top and steel removable sides, so that the outfit can be securely protected against the weather or against tampering.

A trailer type of truck may also be furnished, equipped with solid rubber tired wheels, draw bar for towing, and springs. This outfit is particularly desirable for use in city streets.

### *Angle-Compound Compressors*

Our angle compound compressors have several innovations and improvements. These machines, which have been manufactured for a period of nearly fifteen years, have shown a rapidly growing popularity, on account of their cardinal features of space economy, high air efficiencies, and low power consumption per unit of air compressed at all load stages. The accurate balance of the reciprocating parts of the high pressure and low pressure members, reduces vibration to a very low factor, while the ability of the unit to be operated by either belt or direct connection to an electric motor or an oil engine, and to be coupled in pairs, forming twin units for direct motor drive, gives them a flexibility which is exceedingly convenient.

The new improvements include the "wafer" air valves, which are now used on all sizes of these compressors, and the three-pass counter current intercooler, formerly employed only when especially ordered, to secure extra efficiency, but now a standard feature of all sizes of these machines.

These machines are built in seven unit sizes, giving a range in single machines from 450 to 1700 cu. ft. of free air per minute, and in the twin unit, up to 3700 cu. ft. They are good for working pressures up to 120 lb.

## English for Engineers

A HANDBOOK OF ENGLISH FOR ENGINEERS. By Wilbur Owen Sypherd, Professor of English in Delaware College. 314 pp. Limp leather covers, $2.50. Scott, Foresman & Co., Chicago.

THIS is neither a treatise on grammar nor on rhetoric, but just what the title says it is, a handbok to guide engineers in their technical writing. The first part is taken up with the general problems of engineering writing and the later chapters deal with Reports, Business Letters and Articles for Technical Journals. The form and construction of each is explained and illustrated by a number of examples.

# Excavating and Material-Handling Machinery

PERHAPS in no department of the rock products industry have greater strides been made in the last year than in heavy excavating and material handling equipment. The introduction of caterpillar treads and traction wheels on the heaviest types of equipment bids fair to be a revolutionary advance over previous methods.

## Steam Shovels and Draglines

By Bradlee Van Brunt
Bucyrus Co., South Milwaukee, Wis.

About this time last year we installed the first caterpillar mounting that was ever put under a railroad type shovel, in a quarry. It was more or less of a new development and was looked upon with considerable interest by operators all over the country. During the year 1923 the general acceptance of the tremendous economies effected by this type of mounting under railroad type shovels, has been clearly demonstrated by the large number of quarries that have installed this equipment and the unanimous expressions from all such companies as to the success of these installations.

The writer has been collecting data for the past two months through questionnaires addressed to all these operators, on the success of this type of equipment. (A compilation of these data is given elsewhere in this issue.—Editor.) It appears that not only has there been a saving in operating costs running all the way from 15 to 30 per cent, depending upon the nature of the work, but the output of the machines on which such mounting has been installed has been found to increase from 20 to 30 per cent. Furthermore, the simplicity of the operation has been found to reduce materially, the number of men required in the pit.

It is quite obvious from the above that the saving thus effected, together with the increased output possible, will recommend this mounting as a splendid investment. These caterpillars are so designed that they may be applied to any size railroad type shovel in the field, whether old or new. Perhaps it may be difficult for those who have not witnessed this equipment in operation to understand why it is possible for the output to be increased. The answer to this is simply that the shovel is so easy to move forward that it is possible at all times to keep up close to the bank within the most effective digging reach and get a full bucket load instead of having the bucket come through perhaps half full.

### *Use of Diesel Engines*

During 1923 this company has also made a large number of installations of shovels and dragline excavators equipped with straight Diesel engines. The perfection of this application is a most important development. These machines are so designed that they have even more power at the point of the dipper, in other words digging power, than a steam engine of the same size. This is by virtue of the tremendous fly-wheel velocity behind the pull on the dipper. The Diesel shovel and dragline has been developing so that it is sufficiently strong and powerful to be put in any type of heavy digging, a thing which has not been accomplished heretofore. Of course, the most important element of the Diesel machine is the remarkable fuel economies effected, as the fuel that is burned by these engines is a new type of cheap low-grade fuel oil which will run freely through the pumps. The installation of this type of machine has been particularly attractive in those localities where fuel is expensive and where good feed water is difficult to obtain.

## Small Electric Shovels

By W. E. Day
The Thew Shovel Co., Lorain, Ohio

The most noticeable tendency in connection with power shovel development in the rock products industry is the increased demand for electric and gasoline-driven shovels of the smaller types.

The use of several small shovels in place of one or two large ones admits of full capacity during rush seasons and economical retrenchment when demand decreases. The smaller shovels can be shut down one by one and the deterioration is practically nothing when they are not in operation. The interval can also be utilized for necessary repairs and adjustments.

The illustration shows one of the Type-O Thew electrics mounted on continuous tread handling limestone in the John S. Lane quarries at Westfield, Mass.

Another advantage of the smaller units is that they are operated by one constant-speed motor. This requires much less current consumption to perform the same work than two or three larger motors which must stop and start under load.

The Thew electrics and gasoline shovels are duplicates with the exception of the motors, the gasoline shovels being installed in places where current is not available. The tendency is very strong, away from steam-operated shovels, toward those operated by electricity or gasoline. The economies are apparent. One-man operation. No coal or water to supply. No boiler cleaning or flue rolling. No time lost before or after the day's work. In winter when there is generally a mound of ice around a steam shovel, these advantages are especially noticeable.

Recent improvements in Thew electric and gasoline shovels have developed the same elasticity of operation obtained in steam shovels even to the shaking of the dipper. They are capable of accomplishing anything which can be accomplished by a steam shovel. As the full power of the single motor is applied to each operation of crowding, hoisting and swinging, they are more powerful than corresponding steam shovels.

## Mine Shovels

By G. E. Deatheridge
Hoar Shovel Co., Duluth, Minn.

We are getting out a different type surface shovel, which we hope to have on the market in the spring. The two oustanding developments in the rock products industry as far as the Hoar shovel is concerned, are the facts that we equipped the mine of the International Pulp Co. at Gouverneur, N. Y., and the Green Hill Mining Co. at Gouverneur; one mining talc and the other feldspar, with Hoar shovels. These are the first two installations we have made in the nonmetallic industry and we are very much gratified to say that both of these clients

*Small Thew quarry shovel at Westfield, Mass.*

have written that they are very well satisfied with what has been accomplished.

Where we have done the greatest business this year has been in the Pennsylvania anthracite field, handling blasted rock from their devolpment tunnels. These tunnels are 7x10 ft. in section, a condition which exists in a great many non-metallic mines.

The Philadelphia & Reading Coal and Iron Co. of Pottsville have 12 shovels in these rock tunnels, all of which are doing very good work. In all our dealings with non-metallic industry we find that there are very few underground operations and these are the only operations where we really at this time can get in and do a good deal of active work and prove the machine a cost reducer for them.

The recent report of the U. S. Coal Commission to the President of the United States and Congress, where they have made extensive recommendations for the lowering of costs in the mining of coal, expressly brings to the attention of the President the fact that mechanical loading is a success, and that in the Pennsylvania anthracite mines where they have been changing over from hand to mechanical loading costs have been reduced 30 per cent. Mechanical loading underground is a success and is here to stay, and it is such items as the United States Coal Commission reporting to Congress on a thing of this kind which bring it to the attention of the producer that it is a success, and the government engineers have spent a good deal of time making extensive time study on the matter and have proved conclusively that it does not pay to load by hand underground any more if a person has any tonnage at all to handle.

The conditions in the coal mines are, as far as loading is concerned, not much different than they are in the non-metallic mines. For that reason, it is my personal belief that the non-metallic miner can make a great deal of headway by using mechanical loaders. The two installations we have made for the International Pulp and Green Mill Mining Co. expressly prove this, for at the International Pulp we practically doubled their tonnage without adding another man to their payrolls.

## Largest Shovel in a Limestone Quarry

By Harvey T. Gracely
The Marion Steam Shovel Co., Marion, Ohio

Quite a number of outstanding developments in power shovels marked 1923 as one of the most progressive years in the manufacture of excavating machinery. During the past year the Marion Steam Shovel Co. has designed and installed the largest electric shovel ever used in a limestone quarry. It is in operation at the Michigan Limestone and Chemical Co.'s quarry, at Rogers, Mich. This giant of all power shovels is of the revolving type, and has many new and strikingly important features. Its huge and massive dipper loads 8 cu. yd. of stone at each dip, and it does not do a day's work until it has handled between two and three thousand cubic yards of material.

The use of these large revolving shovels is not restricted entirely to quarry service, for the Marion company have installed quite a number of other machines of the same type in open pit iron and coal mines. In metal mines they are used for stripping overburden and loading ore, but in coal mines their use is restricted entirely to stripping.

Many quarries that do not require the loading capacity offered by the large revolving machines, are successfully using the smaller Marion electric shovels. These are usually mounted on caterpillar trucks. The Marion design, which was announced in the Review and Directory Number of Rock Products a year ago, is different from most types now on the market, in that the three major operations — hoisting, rotating and crowding—are each handled by separate motors. Every prediction made for this new and distinctly original design has been very generously met. Such firms as the Lehigh Portland Cement Co., the Limestone Products Corporation, the Ohio Gravel Ballast Co, Phoenix Portland Cement Co., and many others have found this new Marion design to be equal to every claim made by the manufacturers.

### *New Gasoline-Electric Shovel*

Where line current is not available, the Marion company supplies what they call their gasoline-electric machine. On this type, electric current is generated right on the machine, otherwise the arrangement of the machinery is identical with their electric machines. The gasoline-electric shovels are only furnished in the smaller sizes, and they offer an unusual opportunity to the small operator. All of the inconveniences and troubles of the steam machine are eliminated in this new type. Only one man is required to operate the shovel, and this item in itself, makes quite a reduction in the monthly payroll.

This type was built as a follower of the steam machine in principle, having a motor for each operation. This was to get away from the immense waste caused by using a straight gasoline shovel transmitting its power through clutches, gears, lines and frictions; in all such straight gasoline shovels somewhere around 40 per cent of the total available power is used up in overcoming transmission losses before any real effort is communicated to the excavating parts of the machine. So Marion contends that it shall be three separate motors, one for each motion, crowding, hoisting and swinging.

By reason of the use of electrical transmission all power losses caused by the use of mechanical transmission are avoided and current is paid out to the main motions of the machine without any loss of energy. The motors, when completely overloaded, slow up and finally stall in the same way as the steam engine on a steam shovel.

The power of the gasoline-electric shovel is rather better than the power of the equivalent size steam shovel; its speed and handiness are many percent greater. Its tractive possibilities are practically unlimited; it requires no certificated operator; it requires no fireman. It is controlled as easily as a street car; it consumes gasoline as fuel, which is easily transportable. It uses no more than one pailful of water per day, and this only to make up evaporation loss; there is no danger of freezing in cold weather for the radiator can be quickly and easily drained. All expense stops when the engine stops. It can be operated in inaccessible places where it would be impossible and impractical to attempt to take any other type machine.

The Marion gasoline-electric shovel is meeting with decided success and owners and operators in all industries are endorsing the Marion idea of three separate motors. The Marion company has built both the friction type because of the many costly and unnecessary evils attending.

### *Crawler Shovel Truck*

In addition to the new types of revolving shovels brought out by the Marion company during the past year, they have also produced a wonderfully sturdy design of crawler trucks for railroad type shovels. With these trucks, no tracks, ties or jack blocks are required, and the shovel is always in a position to move. When working along a straight quarry face, the shovel can be turned around in much less time and with practically no expense as compared to the tracks required to turn a similar machine mounted on railroad trucks.

Many users of these shovels in quarries throughout the United States are installing these new trucks on their older machines. The manufacturers state that practically every railroad type shovel purchased for quarry service during the past year has been equipped with these new crawler trucks.

*New Marion crawler truck small gasoline-electric shovel*

## Traction Wheels on Large Shovels

By Carl F. Ebert
The Osgood Co., Marion, Ohio

Without question the greatest development for the rock products industry made by the Osgood Co. during the year 1923 is the successful application of traction wheels to large railroad type shovels. The largest railroad type shovel built, an Osgood 120-ton 6-cu. yd., has been operated on traction wheels for the past several months and its success has been all, and more than was expected. An Osgood 73-ton, 3½-cu. yd. mounted on traction wheels has also been giving equally satisfactory service. Orders for the equipping of several railroad type machines now in the field, have been received.

The chief arguments in favor of the traction wheel mounting are its speed, simplicity of operation and freedom from complex wearing parts. Of course, the elimination of pit crews, tracks, jackarms, etc., must not be overlooked, but these points are also covered by the use of continuous tread trucks. However, in solid bottom quarries where traction wheels can be used they are much superior to the continuous treads because of the reasons already set forth.

The front or driving wheels are of large diameter and extra wide face to give the greatest possible tractive and bearing surface. They are so placed under the machine as to interfere with the dipper in operation very little and in most cases not at all. Steering is accomplished by the rear wheels which are operated by a separate steering engine. Vibration, so common on railroad trucks, is practically eliminated by the traction wheels. Shovels mounted on traction wheels have moved in quarries a distance in one-half day that under old track laying methods, would have required a week. These machines have affected great savings in time, labor and equipment necessary for operation.

The new Osgood 1¼-cu. yd. heavy duty revolving steam shovels have also proved very useful in rock quarries, and several are in use loading rock into industrial cars and also in stripping overburden. The 1¼-cu. yd. H. D. equipped for dragline service is being used for stripping by some quarries. It can be mounted on interchangeable continuous treads or traction wheels and is designed for use as steam shovel, clamshell, dragline or crane. The Osgood automatic safety lever control is a feature of this machine which speeds up the operation and gives the operator full control of the dipper when lowering.

## British-Made Shovels

By W. Barices
Ruston & Hornsby, Ltd., Lincoln, England

There has been an increasing demand for Ruston steam and electric shovels for quarries and opencast mines during the year just ending.

Machines with self-laying tracks have been mostly favored and excellent economic results have been obtained with them.

A large dragline weighing 300 tons net, exclusive of ballast, with 8-cu. yd. bucket and 120-ft. jib has ben completed for India, and a full-circle shovel of the same size for stripping iron ore in England. A repeat order has been received from India, and an electrically operated 300-ton full-circle shovel is on order for Morwell. There is a brisk demand for electrically driven excavators which we are specially catering for.

Many detail improvements have been made on the machines, especially on the caterpillar tracks. The ease and speed with which the machines can be controlled have also received special attention.

## Gas and Electric Power vs. Steam

By G. C. Williams
Northwest Engineering Co., Chicago, Ill.

Beginning with labor and working through to mechanical operation, the gas and electric machines have it all their way clear down the list. One man operates these machines, a 50 per cent labor saving at the outset. When the man quits, so does the machine; it doesn't consume fuel all night nor require a night fireman to tend it. During the day's work, there are often pauses during which a machine lies idle for a time, anywhere from a few minutes to a few hours. Ordinarily, steam is kept up, fuel is burned, all that time, so that the machine will be ready for use when called upon. But, the gas and electric machines quit when the man quits and starts when he starts, and don't consume fuel when they aren't delivering the goods.

The gas machine is particularly economical right now, but even with gas prices at normal or higher, their fuel economy is easily seen there—a drum of gasoline is easily handled and gives approximately two days' service; a ton of coal, which must be trundled in wheel-barrows through the snow, will last about a day. The price of two days' fuel for the gas machine is about the same as one day's fuel for the steam machine, easier to handle, and far more economical. Furthermore, gas is always available, while the coal situation is often tricky.

The old bogey of the frozen hose-line, too, has been forever banished. The hose-line, laying in the snow at close-to-freezing temperature, is a source of trouble to the operator of the steam machine; if it freezes up, delay and expense result. The business of draining it out each time the machine shuts down and the water stops flowing, is a tedious job and causes a labor expense, particularly when there is a long hose-line. And the dangers and troubles resulting from the use of bad water are forgotten.

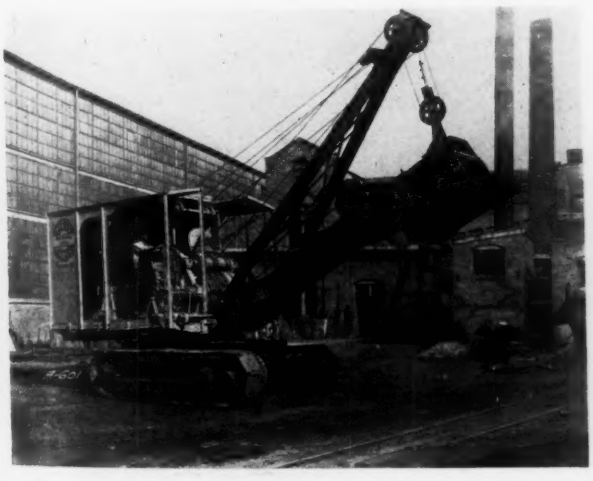
These arguments are specific and deal with certain single phases of operation—but taking the whole situation into consideration, these points boil down to one short phrase, what more can the man who deals with excavated materials want in his handling equipment than this—that the gas and electric machines will positively deliver the *same* goods—*cheaper?*

## Two Recent Developments in Cranes

By A. E. Little
Byers Machine Co., Ravenna, Ohio

One innovation is the Byers-Fogarty shovel attachment for Byers cranes to meet a well defined demand. Both crane and shovel are usually needed on most jobs but operators of small plants will frequently use one tool for both purposes, to save the cost and maintenance of two complete machines. To make both tools available with one investment, the Byers-Fogarty shovel attachment was developed. This attachment has solved some difficulties hitherto encountered in auxiliary shovel attachments. One difficulty has been to make a single attachment easily interchangeable right on the job with either steam, electric or gasoline power plants without the necessity of time-consuming changes in the crane mechanism. The accompanying cut shows the Byers-Fogarty shovel which has overcome these difficulties in the past.

It can be substituted for the material handling crane boom of any Byers crane of the present series in two hours right on the job,



*New Byers-Fogarty shovel attachment for small cranes*

*New full caterpillar self-propelled Byers crane*

and requires no change in the crane mechanism.

The greatest need for auxliary shovel equipment has been in road building, grading, land clearing, removing of overburden in quarries, gravel pits, etc. Therefore this shovel was made especially adaptable to this kind of work.

The Byers-Fogarty has a straight-ahead shovel action with a constant pressure behind it of 20,000 lb. for the full length of its 7-ft. stroke. This feature makes it especially adaptable for the class of work mentioned as well as for old line shovel work. It is a one-man shovel as the bucket is dumped by a trip line from the cab and closes automatically requiring no attention from the operator. (A feature found in no other shovel attachment).

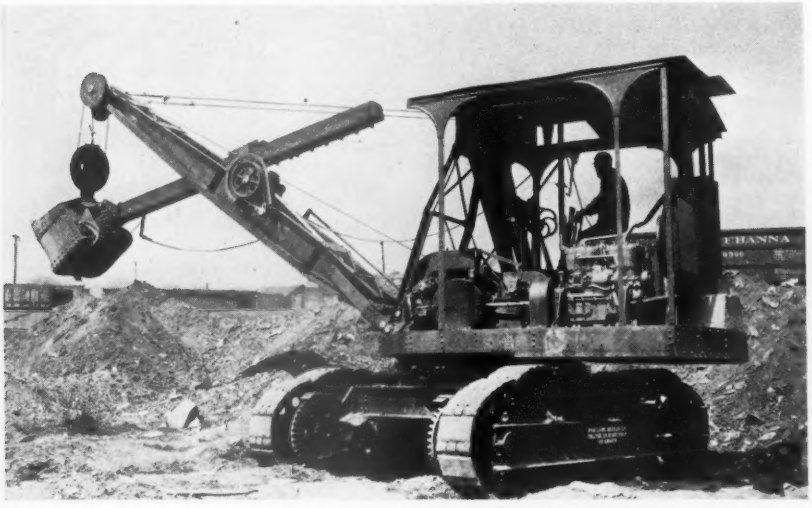
It is designed to fit any Byers crane of the present series and can be secured as additional equipment for Byers cranes now in use.

### *New Light Crane*

Another need has been for a light, but powerful crane, built especially for speed, mounted on full caterpillars, for use in such places as gravel pits, quarries, excavations and other places where sure-footed traction and quick change of position is frequently necessary.

The other Byers innovation is a response to this need, a full caterpillar self-propelled mounting for the Byers Model 1 light crane usually mounted on motor truck chassis and called "Truckrane." The remarkable working speed of this light type crane created a demand for it in such places as pits, quarries and excavations. So the Byers company have now mounted the Model 1 body on a full "cat," self-propelled mounting to make it accessible to places where a motor truck or other mounting could not readily go. It can climb easily in and out of pits and over loose ground and refuse piles when necessary.

The unusually wide spacing of the "cats" makes outriggers unnecessary for stability. This is a decided advantage in soft ground or on a loose base where a footing for outriggers would be difficult to provide. It also makes a quick change of position an easy matter.



*New gasoline shovel by Orton and Steinbrenner*

## New Gasoline Shovel

P. A. Orton, Jr.
Orton & Steinbrenner, Chicago, Ill.

It has always been a problem to make a gasoline shovel as efficient and capable as a steam powered shovel. In operating a shovel, constant crowding pressure must be left upon the dipper stick; it is not sufficient to put a brake upon the crowding gear, as this will not give the desired *pressure* upon the dipper stick. In a steam shovel, this is easily accomplished by the separate crowding engines, but in a gasoline outfit, it must be done by means of the main engine. In previous practice, the stick has been crowded by means of ropes operating on the main drums; however the ropes must make a large number of short bends and are always under considerable strain, so their life is short.

The Orton & Steinbrenner Co., of Chicago, has recently designed a "Dependable" gasoline shovel which is entirely novel in its design. A shaft driven by means of cut spur gears directly from the main hoist is

*Bridge crane installation made during 1923 by the Brown Hoisting Machinery Co. for the Ohio River Sand Co., Louisville, Ky.*

placed between the boom hinge pins. This shaft carries the power by means of two opposed bronze clutches and bevel gears to a shaft along the boom, which meshes with a rack upon the dipper stick and forces the dipper to "crowd." The rack pinion shaft is driven through a two-plate thermoid lined clutch. In practice, this clutch is set so as to slip before the bronze clutch. The dipper is racked out until it begins to dig, after which the thermoid clutch slips, keeping a constant pressure upon the dipper without wearing the bronze clutch or stalling the engine. The flat clutch has radiating pins which prevent excessive heating and the only wearing part is the inexpensive thermoid lining. With this device, a positive gear driven crowding is secured without the inconvenience and expense of ropes breaking and running off the sheaves.

## Material Handling

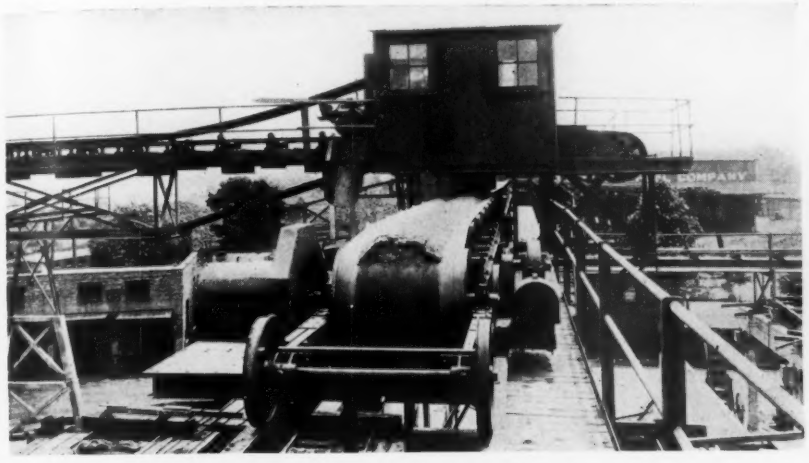
By G. F. Clino, Jr.

The Brown Hoisting Machinery Co., Cleveland, Ohio

A TYPICAL example of the type of improvements in sand and gravel handling is illustrated herewith. During 1923 the Ohio River Sand Co. at Louisville has invested around $250,000 in an electric unloading crane and wharf equipment for handling sand pumped in the Ohio river for city trade in Louisville.

The new plant is known as a bridge crane. A steel bridge is built on the river bank extending back into the yard. The crane, electrically operated, travels on rails but over the water's edge, drops its bucket to the barges, picks up a load, and returns to the shore side, where the contents are dropped into a concrete hopper, which in turn feeds a belt conveyor system. The system is chuted so that the material can be belt delivered directly into cars on the company siding, or carried to almost any section of the yard, and delivered into hoppers or yard piles, as the belt system works on trestles.

A barge contains 250 cu. yd. of material, and gravel weighs around 3000 lb. to the yard. Figured in tons a barge contains about 375 tons. The crane has an unloading capacity of around 200 tons an hour. It is electrically operated throughout, being equipped with three 150-hp. motors.



*Shuttle conveyor over bins at plant of Ohio River Sand Co.*

## New Electric Unloading Crane

By W. S. Doxsey

The McMyler Interstate Co., Cleveland, Ohio

The Birmingham Sand & Gravel Co., of Detroit, Mich, is confronted with the problem of unloading its cargoes of sand and gravel in minimum time, and in moving this material from the dock into the adjacent storage yard so that the dock may be cleared to care for the cargoes of other vessels.

The accompanying illustration shows a

*Large size electric McMyler crane and a No. 2 steam-operated convertible*

large electrically operated traveling crane, developed and erected by the McMyler-Interstate Co., Cleveland, to handle materials at this plant with an unusual degree of rapidity.

This crane has a working radius of 90 ft. and handles a clam-shell bucket having a capacity of 4 cu. yd. Under normal conditions, the crane makes at least two trips a minute swinging to an angle of 105 deg. and return. The hoisting speed, maximum load, is 200 ft. per minute.

This large crane is designed to travel on a track of 20-ft. gage either straight or with curves, with 90-ft. minimum radius. The wheel base is 21 ft.

The arrangement of the operating mechanism is such that any or all functions of the crane may be performed either singly or simultaneously.

The same illustration shows a McMyler-Interstate No. 2 steam-operated convertible crawler crane, equipped with a 40-ft. boom and a two line, ¾ cu. yd. clam-shell bucket. This crane is used for re-handling materials, as well as for loading into hoppers and trucks. It is also used for reclaiming materials at the edge of storage piles which are beyond the reach of the large crane.

## Manganese-Steel Parts for Equipment

By C. B. Andrews
Taylor-Wharton Iron & Steel Co., Highbridge, N. J.

The year 1923 has been a busy one for the Taylor-Wharton Iron & Steel Co. Its tonnage of manganese steel castings is made for customers very widely distributed, not only in this country, but in many foreign countries. The castings are used to resist abrasive wear in all kinds of heavy machinery and a large portion of it goes to the operators of mines and quarries and the producers of mineral aggregates.

This company has been making iron and steel continuously since 1742—181 years. In that time, many changes have taken place in the character of its product. At first, iron shoes for horses and oxen, mails and crude farming implements were made, as well as cast cannon balls for the Colonial and Revolutionary wars. In later years, car wheels and axles, forgings and iron castings were added, but in 1892, the company started to make its present specialty—"Tisco" manganese steel. Ever since then, the plant at High Bridge, N. J. has produced very little else. The operators of steam shovels and dredges, mines and mills, quarries and gravel pits have come to realize that their plants cannot be run economically without the use of manganese steel. Profits disappear when repairs have to be made too frequently, but replacements are rare when wearing parts are made of manganese steel.

This alloy steel has the property of being non-magnetic so that it can easily be identified. Operators should remember that it is heat-treated at the foundry to remove its brittleness and that it should not be re-heated in service or else its toughness will be lost and it will revert to the original brittle condition. The steel is not commercially machinable with cutting tools which makes it necessary to perform machining operations by grinding.

In many respects, the use of "Tisco" manganese steel has become standardized, especially in the design of wearing parts for crushers of all types, but new uses and new designs are continually being worked out. During the past year, satisfactory service records have been established on several recent improvements in steam shovel parts. Instead of making dippers of the composite type, there have been made in several sizes, ranging from ⅞-cu. yd. to 2½-cu. yd. capacity, dippers with the body consisting of a single manganese steel casting. The wearing lip is separate and riveted to the body. In some cases, the dipper tooth bases have been cast integral with the lip. This construction is very rigid and strong. It has worked well in tearing up old bitulithic highways and in rock digging.

There are few steam shovels now using the old solid teeth; nearly all are equipped with the Panama or Panama reversible manganese steel teeth, but the latest design which is rapidly being introduced is known as the Van-Port reversible. In this type, the surfaces of the base and point which fit together are simple and easily ground. The point is drawn into place by a wedge bolt and held against motion in all directions. This tooth is patented and applications are also pending on the one-piece dipper and a lip with bases cast integral.

## Cableway Excavators—Increase in Range of Operation

By Louis McLouth
Sauerman Bros., Chicago, Ill.

Anything that will without additional operating cost add from 100 to 400 ft. to the length of operation of an excavating and conveying unit is a decided saving for sand and gravel producers.

Just that thing has been accomplished in the past year by Sauerman Bros. with their slackline cableway excavators.

By a complete development of all types of power units, steam, electric, gasoline or belt driven, they have made it possible for any sand and gravel producer located anywhere to now buy a slackline cableway excavator having an operating span of from 100 to 400 ft. longer (depending upon size of machine used) than it was possible to furnish heretofore.

This longer span machine is capable of the same yardage outputs as formerly could be obtained with the shorter span outfit.

It is simply a question of a faster operating speed so that the bucket will still make as many round trips in a given length of time over the longer span as used to be made over the shorter span.

In addition to furnishing the necessary two speed steam, gasoline and belt driven power units for any size of machine which heretofore were not obtainable, Sauerman Bros. have also developed an entire new type of electric power unit. The outstanding feature of this electrically-operated unit is the fact that the change of speeds is accomplished electrically within the motor itself thus doing away with all the complicated mechanical change of speed design which formerly had to be used on electric hoists for this class of work.

As a result of all this, during the year 1923, it has not been unusual for Sauerman Bros. to furnish Sauerman slack-line cableway excavators to sand and gravel producers operating on spans up to 1000 ft. When it is recalled that only two or three years back an economical range for these machines was considered to be about 600 ft., it is easy to see that the accomplishment really amounts to something. Also when it is kept in mind that there is no increase in labor, fuel or other operating expenses, only a slight increase in initial cost of machinery and no reduction in capacity, it is seen that a real economic saving is the result.

## Developments in Hydraulic Dredges

By V. J. Milkowski
Morris Machine Works, Baldwinsville, N. Y.

The outstanding achievement or task that has just been brought to culmination after much time and study during the last two years by the Morris Machine Works is a new line of heavy duty dredging pumps of high efficiency, designed especially to reduce wear and to reduce the power consumed.

It has been an accepted axiom among the engineers and users that a dredging pump is necessarily inefficient as a pump and that is must necessarily be worn out in a short time. Through a series of observations and tests, it has been definitely established that the wear is proportionate to the amount of power wasted within the pump; that is, the lower the efficiency of the pump the greater the amount of power wasted, the greater is the wear and vice versa. It was further established that with proper design and workmanship a dredging pump can be made to compare in efficiency with the best practice in water pumps.

Recognition of these facts, together with studies on the location and intensity of wear on the different parts, and studies of the resistance to the wear of the different metals, has led to the adoption in the new pump of a design possessing high efficiency, adoption of manganese steel for all parts subjected to wear, and the adoption of cross sections and distribution of metals best suited to give long life to the pump parts. The saving in power and repair bills made possible by this new design will prove a boon to all pump users.

Pumps of the new design are made to fit the sub-base and bearings of the old style pump, so that it will only be necessary to renew the water end to change from the old style to the new.

Next in line of new achievements may be mentioned the jet agitator for the suction. This was really developed in 1922; but some improvements have been effected, and more reliable data on its performance was secured during the current year.

First in rank of sand and gravel installations during the current year is the 15-in. dredging pump and booster pump furnished to the Fuller-Becker Sand and Gravel Co., of Oxford, Mich. The pumps are of the heavy duty type, and each is directly connected to a 400-hp. variable speed motor. The material is delivered directly to the screens at a point about 1000 ft. from the dredge, and about 70 ft. above the water level in the pond. This distance can be increased considerably as the material is taken out. The dredge is equipped with a jet agitator, and with a stone box in the suction line. The pump supplying water to the jet agitator is a 6-in. double suction, horizontally split pump directly connected to a 100-hp. motor. The jet agitator has proven to be of special value in breaking through strata of clay and cemented material, and in making the feeding of material to the suction uniform, while the stone box has reduced the number of shut-downs resulting from choking up of the suction by oversized material to about one-eighth of what it would have been otherwise.

The foregoing summarizes, in the small space available, the main things done by our organization during the year of 1923 in the sand and gravel industry, which may already be classed as achievements and which we have reasons to believe will be of special interest to the readers of this publication.

We have reasons to expect that the year of 1924 will see even greater progress and accomplishments in our field.

# Transportation Equipment and Accessories

PROBABLY the outstanding development in plant transportation in 1923 was the continued growth of the gasoline locomotive and the steps taken by manufacturers to still further increase its efficiency. During the year the Ford Motor Co. has been preparing to enter this field directly. Many Ford motors have been used by manufacturers of small locomotives.

## Growing Popularity of Gasoline Locomotives

By H. R. Sykes
The Fate-Root-Heath Co., Plymouth, Ohio

We have noted with a great deal of pleasure a very marked increase in activity in the rock products industry throughout this country; this being as marked on one coast as the other and in the extreme South and extreme North including Canada.

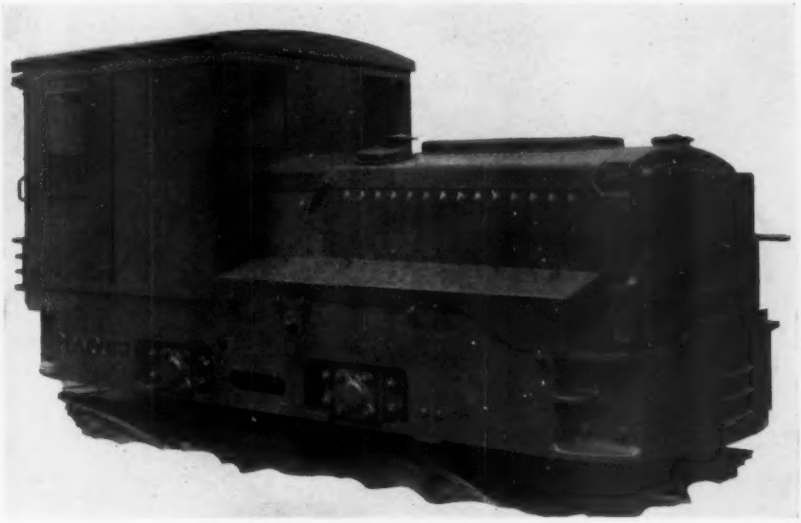
This activity seems to be marked in all of the fields making up the rock products industry and to us indicates splendid business ahead for the coming year in the building industry and others, more or less indirectly applied with it. Plymouth gasoline locomotive installations have been made in all of the different branches, such as crushed stone, lime, gypsum and cement, embodying such installations as Los Angeles Rock and Gravel Co., Los Angeles, Calif.; Monolith Portland Cement Co., Los Angeles; Lawrence Portland Cement Co., Siegfried, Penn.; Cayuga Operating Co., Portland Point, N. Y.; Orange County Rock and Gravel Co., Orange, Calif.; Phoenix Stone Co., Arrington, Va.; Canada Cement Co., Winnipeg, Man., Canada; Washington Building Lime Co., Baltimore, Md.; Ohio Hydrate and Supply Co., Woodville, Ohio; Alpha Portland Cement Co., Easton, Penn.; Atlas Portland Cement Co., Hannibal, Mo., and the Ford Motor Co. for use in their silica sandpits.

The new Model FL 4-ton 4-speed gear-drive gasoline locomotive, just announced by The Fate-Root-Heath Co., promises to be a very popular one for work within its rating on account of its rugged and substantial design and construction and its unusual power. It is built on the same general design as the well-known Model DL 7-ton gear-drive Plymouth.

This new model easily develops a draw bar pull of 3000 lb. in first speed on sanded rail and a correspondingly high draw bar pull on higher speeds. The speeds provided are 2⅔, 4, 8 and 12 m.p.h., either forward or reverse.

As in the Model DL the long main drive chain is eliminated by substitution of an additional gear in the transmission, thus greatly strengthening the locomotive at this point and reducing the possibility of interruption of service on this score at least one hundred fold.

The clutch is of the twin disc design modified to suit the particular installation in this model and embodies combined clutch-retarding and auxiliary brake. It is of the dry plate type with exceedingly large faces and very easy of adjustment.



***Latest type of Plymouth gasoline locomotive***

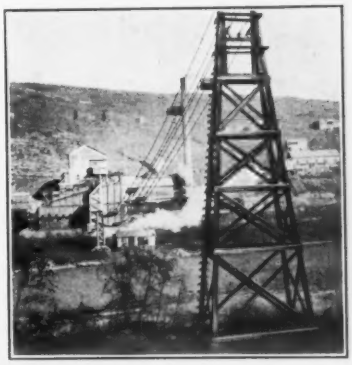
The power plant consists of a Waukesha Model Y 4-cylinder vertical engine with cylinders having 4-in. bore and 5¼-in. stroke, equipped with removable cylinder sleeves and having full force feed oiling system.

## Aerial Cableways

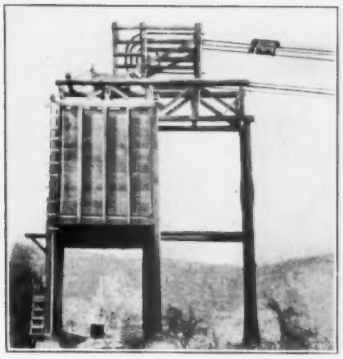
By L. M. Hugo
Interstate Equipment Corp., 25 Church St., New York City

A notable, and at the same time a typical, recent installation by the Interstate Equipment Corp. is that at the Virginian Limestone Corp.'s quarry, crushing, and screening plants at Klotz, Va., located on the bank of the New river with rail connection with the Virginian railway. The field supplied by the Virginian railway being of limited extent the company, for some time, had been desirous of obtaining a direct connection with the Norfolk & Western railroad, the line of which is located on the opposite bank of the New river.

The connection as originally contemplated involved the construction of a bridge across the New river. The expenditure for such a connection was prohibitive and the matter was held in abeyance until the management recently became familiar with the automatic aerial tramway, which is the improved Lawson type. By the expenditure of a comparatively small sum of money they were able to establish a satisfactory connection with the Norfolk & Western railroad, which opened up a very large market and developed much more business than had been anticipated.



***Aerial cableway installation by the Interstate Equipment Co. for the Virginian Limestone Corp.***



***Railway car loading bin of aerial cableway***

The tramway was originally installed to handle 30 tons per hour but the unexpected demand caused additional cars to be placed on the line and at present 50 tons per hour are being handled.

The equipment was not only inexpensive to install but is most economical in operation as the services of only one laborer are required. The carriers, which load and unload while in motion, consist of four wheeled cars running on an aerial track of wire ropes supported by the terminal and two intermediate towers with a single span of 550 ft. across the river.

The two ropes forming the top track carry the loaded cars which, as they pass through the reversing rails of the discharge terminal, are turned upside down, discharging their load and return in that inverted

position over the bottom track placed directly underneath the loaded track. At the loading terminal another pair of reversing rails turn the cars right side up again and they then pass under the loader from which they take their load automatically by means of an automatic trip.

The crushed and screened limestone is delivered by a belt conveyor from the main bins to a small bin directly over the loading terminal and from this it is fed to the automatic loader which is also a measuring hopper as it holds just enough for a tramcar load.

At the discharge terminal there is a two-compartment bin placed directly above the side track with provision for enlarging this later by adding two more compartments above a second side track. This will then provide a bin practically square in plan divided into four square compartments by means of partitions in the form of a cross. The discharge terminal of the tramway is placed above these bins and discharges directly into any desired bin.

## New "Milwaukee" Gasoline Locomotive

By A. C. Paul
Milwaukee Locomotive Manufacturing Co., Milwaukee, Wis.

The new Milwaukee Type "H" locomotive is built in one standard design, in sizes of 3½ to 15 tons, is furnished for all gages of track and equipped either with or without electric starting and lighting.

The frame consists of cast-iron sides with reinforced channel iron end sills. The locomotive will be equipped with couplers of the link and pin or standard M. C. B. type as may be specified. The journal box yokes are of such design as to provide an easy and ready means for chain adjustment.

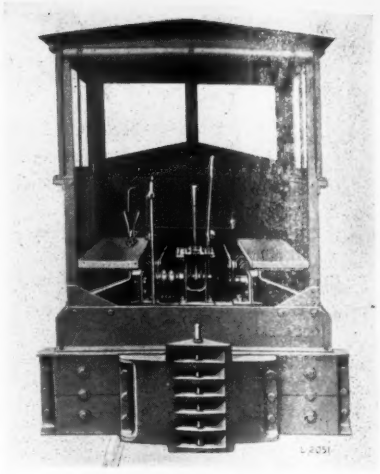
The engine of Types "H3" and "H4" (3½- and 4-ton) machines is of the well-known Hercules Model "O," 4-cylinder, heavy duty type, having a 4-in. bore and 5-in. stroke, and capable of developing 40 hp. at 1400 r.p.m.

The engine of Types "H6" and "H7" (6- and 7-ton) machines is of the Beaver Model "JE," heavy duty, 4-cylinder type which has overhead valves and removable head. It has a 4¾-in. bore by 6-in. stroke and at 1000 r.p.m. will readily develop 50 hp.

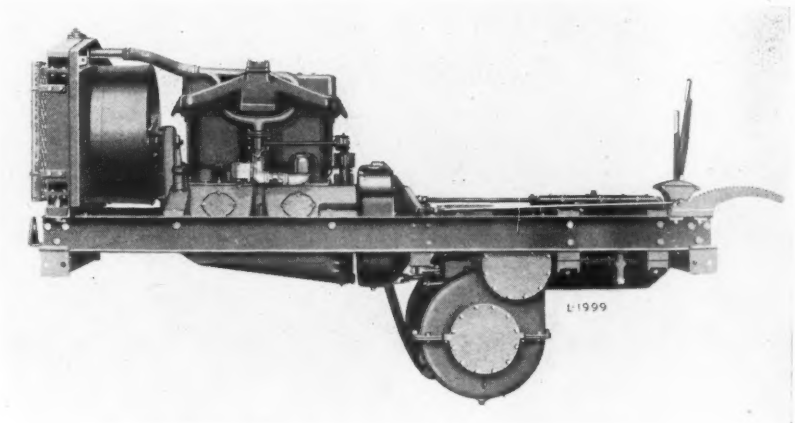
All engines used in the "H" type locomotive have forced feed lubrication and forced water circulation. The journal bearings are the well-known Hyatt roller bearing duty type.

The engine of Types "H9" and "H10" (9- and 10-ton) machines is of the Beaver, 6-cylinder, heavy duty type, Model "JD," 4¾-in. bore by 6-in. stroke, and has overhead valves and removable head. The radiator is of the Modine, sectional spirex core type. The clutch is of the multiple disc dry plate type, of ample capacity and designed especially for heavy duty service.

The transmission, which is of our latest design, is of the jaw clutch and gear type. In this type of transmission the gears are always in mesh, the speed changes and direction of travel being effected by means of jaw clutches. It is designed especially for heavy duty service in which the possibility of stripping the gears has been entirely eliminated. It is geared for 4 speeds both forward and reverse. Standard truck type of gear shift control is employed.



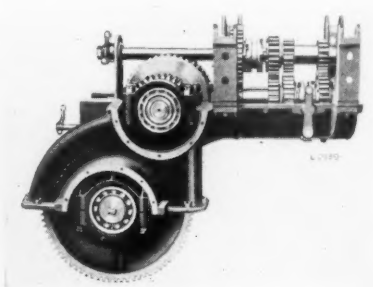
*Control of new locomotive*



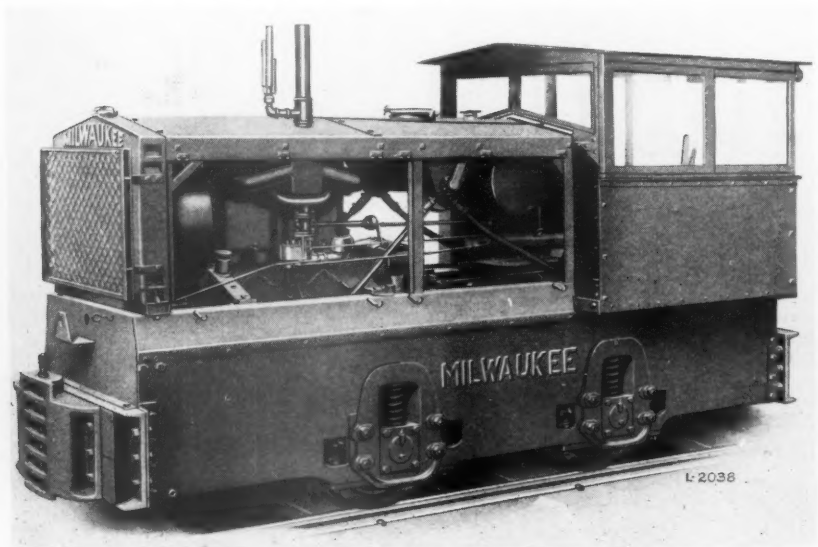
*Engine and mounting of new Milwaukee locomotive*

Only two heavy roller chains are employed to transmit the power from the transmission drive shaft to the axles.

The design of the brake is a radical departure from the regular 4-wheel brake, the brake being of the drum type, with the brake drum mounted on the drive shaft of the transmission. This type of brake has been found to be equally as effective as the 4-wheel brake and has the advantage of being far more simple in design and consisting of practically only one-fourth the number of parts usually contained in the conventional wheel brakes. It is operated by a hand lever and also requires less attention, having but one adjustment. Type "H" locomotives are equipped with whistle actuated by the exhaust from the engine.



*Driving gears of new locomotive*




*Latest type of Milwaukee gasoline locomotive*

# Crushers and Pulverizer Developments

THE OUTSTANDING development in the crusher and pulverizer field has been *keen competition*, but nevertheless a tendency toward bigger, stronger and more rugged equipment. In no branch of the rock products industry does the producer of rock products have such a wide range of machinery to choose from; and the particular needs of his plant and material should be thoroughly studied before making his choice.

## Developments in Hammer Mills and Pulverizers

By Paul W. Webster
K-B Pulverizer Corp., New York City

Two important developments have taken place in connection with the K-B all-steel hammer mills and pulverizers during the year.

Heretofore these machines have been built in sizes with capacities up to about 25 tons per hour. They are now offered in sizes with capacities up to 200 tons per hour.

In these larger sizes the same principles of design with solid U-type hammers and over-running direction of rotation have been retained, as well as the simple, patented, eccentric pin adjustment for wear. These are the features which are responsible for the low power consumption and large capacity characterizing these mills, while the use of cast steel frame and manganese steel hammers, liner plates, and screens reduces wear to the minimum, and is practically absolute insurance against breakage from any cause.

### *Powdered Coal Mills*

The second development is the adaptation of the simple, efficient principles of the hammer-mill to the preparation and firing of powdered coal.

Realizing the great savings and economy to coal users in burning powdered fuel and, anticipating the present demand for a simple unit type machine, extensive experimental work was started nearly three years ago.

It was determined that to be successful such a machine must take bituminous coal as it comes from the cars, pulverize it and inject it into the combustion chamber without drying or storage, complicated piping, valves or auxiliary apparatus, and without the attendant fire or explosion hazard inseparable when these are required;

That minimum power consumption was dependent on immediate removal of all particles as soon as they had reached a sufficient degree of fineness;

That with air separation only could successful separation of the sufficiently fine from the unground particles be accomplished; and

Further, that the air used for separation should also serve to transport the fine coal to the point of burning.

Extensive experiments confirmed previous work of others, *i.e.*, that air separation of fine from coarse particles cannot be successfully accomplished within the grinding chamber. Either an excessive quantity of coarse particles are removed, or capacity decreases and power requirements increase inordinately.

Eventually the "Pulverburner" was developed and has been, after many months of commercial use in privately owned and public service corporation power houses, recently offered to the general public.

The "Pulverburner" differs from the K-B hammer-mill in that it has solid grinding plates in the lower half in place of the customary screens and the discharge is upward by centrifugal force into a separating chamber.

This chamber affords the enlarged space and comparatively quiet and rarefied atmosphere essential to efficient separation. A fan draws out the fine particles and delivers them to the combustion nozzle, while the coarse particles fall by gravity and back into the pulverizing chamber.

The constant sweep of air through the machine removes all moisture—coal carrying as high as 15 per cent surface moisture and 20 per cent ash has been pulverized and burned in commercial practice—while the instant removal of fines as fast as produced insures the conditions essential for minimum power consumption.

Manganese steel grinding hammers and liners and non-wearing grinding plates reduce upkeep to a few cents per ton of coal pulverized, as well as insure against breakage from "tramp iron," while the general details of design and construction are the result of ten years' experience in building heavy duty mills of similar type.

The entire apparatus is under suction and a partial vacuum, hence there is no escape of coal or dust, and the fact that it meets the requirements of the National Board of Fire Underwriters best answers any question of fire or explosion danger.

## Gearless Crushers—Air-Swept Tube Mills

By P. E. Van Saun
Kennedy-Van Saun Mfg. & Eng. Corp., New York City

The increasing sales of our gearless gyratory crushers, many of them repeat orders from satisfied customers, are convincing proof that gears on a gyratory crusher cause a useless expenditure in maintenance and waste of power. All sizes of our gearless crushers of both primary and reduction types have been equipped with the ball-bearing drive which reduces the friction loss. What is even more important in the ball-bearing type is that the belt pull is removed from the eccentric, a flexible coupling transmitting the power to the eccentric as pure torque.

Our gearless crusher is now being built with the motor direct connected through flexible coupling and mounted under the frame where it is fully protected. A special duplex synchronous motor is used which has large starting torque and, likewise, improves the power factor of the load.

For fine grinding our air-swept ball tube mill has earned popularity. Its correctness in principle of operation is unquestionable; that of removal of the finished material from the mill as and when it is produced by an air current of adjustable velocity and volume.

Our air-swept tube mill is successfully operating on a variety of materials such as gypsum, talc, limestone, coal and cement. By a simple regulation of the fan speed and of a couple of dampers, the fineness of the product can be governed as desired from 16-mesh material to one of such fineness that 99 per cent passes a 350-mesh sieve. The output per horsepower hour has been increased approximately 100 per cent over that formerly attained in tube mills.

In connection with our air-swept mills it was found that no fan, as hitherto manufactured, was satisfactory for handling the product. We have, therefore, built a line of fans with Herculite steel impellers and with the housings lined with the same wear-resisting material which has solved the problem of minimizing wear when handling abrasive materials. These fans are suitable for handling dust-laden gases such as in connection with waste-heat boilers of cement plants where the abrasion on fans of ordinary construction causes frequent shutdowns for repairs.

## Hammer Mills for Large Size Rock

By R. F. Schneider
Williams Patent Crusher & Pulverizer Co., St. Louis, Mo.

Crusher plant simplification and accomplishment of the same results with fewer crushers of larger crushing ratio has been the aim of all recent developments in hammer crushers and crushing plants built by the Williams Patent Crusher and Pulverizer Co., of St. Louis, Mo.

One of the latest type, the "Mammoth," reduces stone as large as 48-in. cubes to ¾-in. and finer in one reduction, and does the same work as usually requires a primary breaker and recrushers. The 48-in. stone to ¾-in. means operation on a crushing ratio of 64 to 1 and obviously will effect a material saving in the production of many quarry products. Cement plants, for example, can now do all of their raw grinding in two operations, as the "Mammoth" crusher breaks the rock to ¾-in. and finer for finishing with Compeb or similar type fine grinders.

The "Mammoth" is a development of the Williams "Jumbo" type well known and used by many American cement plants. As many "Jumbo" crushers have been in use for a number of years reducing stone as large as 24-in. to ¾-in. and finer, large ratio crushers are far from being an experiment.

Considered on a basis of first cost, numerous cases have shown that plants of given capacity can be equipped for 50 per cent smaller investment, for not only is actual crushing equipment reduced, but much accessory equipment such as drives, motors, elevators, and large buildings are also made unnecessary.

Operating expenses also show much in favor of larger ratio crushers and obviously this should be the case, as fewer operations mean less power, less wear and tear and less supervision. At one plant where a careful record of all costs was kept, a 53 per cent reduction in crushing cost was reported.

Nor is this method limited to any particular kind of crushing as "Mammoth" crushers are now in successful operation in almost every branch of the quarry industry, including plants making cement, crushed rock, stone for kiln burning, also plaster. Adjusted for any particular size, the finished product is unusually uniform with no oversize material and a very small percentage of undersize goods when machine is set for coarse work such as macadam or kiln stone. The same machine can be set to produce any size from ¾-in. and finer up to 9-in. cubes.

That larger ratio crushers and fewer operations is the method of the future cannot be doubted when you consider the remarkable performance of machines now in operation and the number of new plants designed by well-known engineers whose equipment will include "Mammoth" crushers. Among these new plants are those of the Trinity Portland Cement Co., Dallas, Texas; Columbia Portland Cement Co., Portland, Ore., and the new plant of the Yosemite Portland Cement Co., Merced, Calif., designed by the Hunt Engineering Co., Kansas City, Mo.

## Jaw Crushers in the Joplin Mining District

By J. C. Landon
United Iron Works, Kansas City, Mo.

The United Iron Works has entered the quarry and gravel plant field in a large way, having had 30 years' experience in developing jaw crushers for particularly hard service.

In the Tri-State zinc-lead district embracing parts of the three states of Missouri, Oklahoma, and Kansas the crushing of the ore as the primary step in the preparation of zinc-lead concentrate is one of the most important problems. The ore of this district is lead and zinc sulphides, occurring in flint or chert gangue, and must be crushed to pass a ⅜-in. screen before primary treatment. The flint, or chert, of this field is extremely hard and abrasive and presents a two-fold problem as follows:

On account of the hardness of the flint any crushing machinery used must be of heavy design and proper proportions to withstand the terrific pressure required in breaking down the flint.

On account of the high abrasive properties of the crushed sharp flint all wearing surfaces must be extremely hard to withstand it.

Jaw crushers of the "United" Blake type have proven much superior to any other type of primary crusher. A few gyratory crushers have been tried but were not successful from the point of economy.

A brief description of the jaw type crusher in use in this field is as follows: The bed plate or crusher frame is cast in one heavy piece and made of tough gray iron. The bearings for the eccentric shaft and the bumper shaft are integral parts of the crusher bed itself—thus assuring perfect alignment. The bed is fully protected from wear by removable breast, false and side plates. These plates receive all the side wear and are easily replaceable. On crushers 18 in. and larger the eccentric bumper is of the water cooled type. The bumper, or pitman, is one solid casting and very heavy and strong design. The jaw bumper is suspended from the jaw bumper shaft, the swinging jaw itself being held firmly to the jaw bumper by means of the jaw bumper lip, which is of steel and steel wedge bolts. The eccentric shaft is turned from a high-grade steel forging and is amply strong for all requirements. The flywheels are accurately turned and balanced and are keyed to the eccentric shaft. The jaws and wearing parts are made of a special mixture of semi-steel with a manganese and titanium alloy. This material is commonly called United "hard iron" in this district but is really what is known to foundry experts as "chilled white iron." These jaws compare in wearing qualities with steel—yet their cost is less than one-third as much. The wear on the jaw is taken up by means of a toggle wedge block. This adjustment can be made while the crusher is in operation, if desired. The toggle plates are easily replaced and the crusher does not have to be disassembled when replacements of new wearing parts are made. The main eccentric bearings are of the chain-oiling type, insuring proper lubrication.

## A "Bulldog" Finishing Crusher

By Lewis A. Rice
Traylor Eng. & Mfg. Co., Allentown, Penn.

The introduction by us of the "Bulldog" jaw and gyratory crushers some four or five years ago was undoubtedly the greatest advance in crushing machinery that had been made since the first Blake type jaw crusher was built and the original Gates gyratory placed on the market. This is evidenced by the ever-increasing demand for the "Bulldog" crushers from operators, both old and new.

During the past year we brought out what is known as the "Bulldog" finishing crusher. This crusher was originally designed some four years ago, since which time we have had it on the testing-block and have tested it out in every conceivable way, and when finally some six months ago we advertised and placed this machine on the market we were truly convinced that it would fill a much-needed place in the rock products industry for a crusher that would produce great quantities of ¾-in. to 1½-in. stone at minimum cost. This crusher is extremely heavy throughout; in fact, it is the heaviest and strongest gyratory crusher of its size that has ever been placed on the market. In other words, it is built to stand the hard, continuous service that a crusher for producing from ¾-in. to 1½-in. stone has to when in continuous operation. In fact, these crushers are made to run "buried" all the time. These crushers have vertical reversible concaves held in place without zinc, which can be easily and quickly turned end for end without heavy lifts or dismantling the crusher in any way. The finishing crusher is the only real new development in our line, although we have made improvements in some of our other equipment, notably the designing and building of what is known as the Ajo type crushing rolls. These rolls are the largest and heaviest so far built by any concern and are 78-in. diameter and 24-in. face. The estimated capacity of this machine is four to five hundred tons per hour when crushing 3 and 4-in. stone to ½. The spring pressure is 30,000 lb. per inch of roll face and the four tension rods are each 7½ in. in diameter and the total weight of the machine varies from 300,000 to 400,000 lb., depending on the width of the roll faces.

### *Compartment Tube Mills*

We might also call attention to the three compartment tube or ball mills which we also built for the New Egyptian Portland Cement Co. These mills are 7x26 ft. and are divided into three compartments with a specially designed diaphragm screen separating the compartments. Each compartment is charged with a different size of balls so as to get the most efficient grinding possible. The results attained so far fully sustain the claim that a mill built along these lines and charged with the proper sized balls in each compartment in relation to the work to be performed in that compartment is the most efficient type of grinding mill.

## New Ideas on Crushers for Gypsum

By R. Lowe
Butterworth & Lowe, Grand Rapids, Mich.

Opinions vary as to the best types of machines for converting gypsum rock into plaster-of-paris.

*Initial Crushers*—Gyratories do splendidly for hard minerals, but seem not suitable for soft rocks like gypsum. Their narrow, curved jaw-opening is not rightly shaped to receive large chunks and their construction is too ponderous for gypsum, like using a heavy truck for a pleasure ride. Labor scarcity is forcing the use of larger initial crushers to avoid hand labor in breaking down big chunks, and swing-jaw crushers with large oblong jaw-openings seem to be therefore growing in favor.

*Secondary Crushers*—A rotary crusher set close below the discharge end of the initial crusher seems best. A high-grade rotary thus does this work at the lowest possible total cost, needing no attendant and only a minimum of power.

*Grinding Machines*—Some 30 or 40 years ago almost all gypsum was ground by upper-runner buhr-stone mills. Later the fashion changed and cage pulverizers, emery mills, horizontal spindle mills, hammer mills, air-separation mills, ball and tube mills succeeded one another in popularity. For usual plaster trade there now seems to be a growing demand for a return to the buhr-stone mills but of the more efficient under-runner type.

## Improvements in Telsmith Crushers

By Charles F. Smith
Smith Engineering Works, Milwaukee, Wis.

The most important improvement in gyratory construction during the year 1923 undoubtedly was the substitution of *steel* instead of gray iron in the main structure of the "Telsmith" primary breaker. Of course, all manufacturers have been furnishing occasional crushers with either steel frame or steel crown, or both. However, in these exceptional cases, the steel castings have been made from patterns designed for casting in *gray iron.* The cost has been very heavy and deliveries slow. Not until this year has any manufacturer *standardized* on steel construction for gyratory crushers.

Our guarantee covers not only frame and crown but also central shaft. It runs for two years; and it includes breakage by tramp iron.

While this change from iron to steel was the biggest improvement in the "Telsmith" crusher, important changes have also been made during 1923 in the adjustment and lubrication.

Steel construction has also been adopted for the "Telsmith" reduction crusher. The same guarantee likewise applies.

## Grinding With Rods

By Oscar H. Johnson
The Mine and Smelter Supply Co., Denver, Colo.

Until rather recently the use of rod mills for grinding purposes was confined to comparatively small units. Where large grinding operations were contemplated, operators were extremely skeptical concerning both their capacity and efficiency, and for a long time no one seemed willing to invest the money for an actual test of consequence. Hence the development of rod mills for large capacity grinding is of quite recent date. Curiously enough, the pendulum, once it got started, has swung to the other extreme. The past year has seen rod mills manufactured and installed in the largest sizes of any grinding machine built.

The most notable installations of the year have been made in the metal mining industry, and in each instance the rod mill was selected on account of the reduction in

grinding costs. The Phelps Dodge Corporation, after having been large users of smaller rod mills for several years, selected the new, modern type of large rod mill for all of their plants—experience had demonstrated that they could thus save about 25 per cent on their cost of crushing. They purchased 36 of the 6 ft. by 12 ft. Marcy rod mills.

The New Cornelia Copper Co., at Ajo, Ariz., are installing 20 of the same type to grind the ore in their new 5000-ton concentrator.

The Hollinger Consolidated Gold Mines, Ltd., of Timmins, Ontario, had for years operated with stamps. After elaborate tests with various makes of more modern grinders they finally selected rod mills, and they are now replacing the stamps with five huge 7 ft. by 15 ft. Marcys—which, by the way, are said to be the largest ore-grinders ever built. As a matter of fact it is becoming increasingly apparent that virtually all important mining operators, on this continent at any rate, are devotng careful attention to the subject of grinding with rods.

The interest of operators of industries requiring dry grinding is likewise actively aroused in the subject of rod-mill grinding. Partly because of the activity of the mining industry in that directon, partly because of the splendid construction now embodied in these machines, and partly because they can be secured in units as large as desired. Already rod mills are being used in gypsum plants, brick plants, terra cotta factories, insecticide plants, et cetera.

The speed of the rod mill is slow, the power consumption low, and the cost of rods is less than that of balls. Simple types of liners can be used, and it is exceptionally easy to keep in repair. These factors combine to make it a highly desirable machine for industrial work.

Gauged by the rod mill's rather exceptional strides during the past year, it seems altogether reasonable to expect far greater use of that type of grinder in the future. It would not be surprising to see the rod mill supplant much of the present day grinding equipment in the cement industry for the reasons suggested.

## Improved Methods of Milling Feldspar and Silica

By C. F. Metz
Hardinge Company, York, Penn.

Up until about two years ago, the equipment used for the milling of feldspar and silica or flint consisted of chaser mills followed by batch pebble mills, commonly known as cylinders, or by the well-known long continuous grinding tube mills. In some cases jaw-crushers were used to crush the feldspar in place of chaser mills preparatory to feeding the batch or tube mills.

About a year and a half ago, the Golding Keene Co. of Keene, N. H., installed an 8 ft. x 36 in. Hardinge conical pebble mill and a 14-ft. Gayco air separator to grind their feldspar. The operation of this plant is as follows:

The feldspar is fed from storage piles inside of the building by hand into a 9 in. x 16 in. Reliance jaw crusher equipped with flat manganese steel jaw plates designed for fine crushing and set to deliver ½-in. product. This crusher discharges its product into a bucket elevator, which lifts the crushed material to a 25-ton storage bin.

The crushed material is fed with a disc type measuring feeder through a manganese steel chute into the 8-ft. diameter by 36-in. cylinder Hardinge conical pebble mill. This mill is specially designed for dry grinding, having 23-in. diameter main bearings, which are water jacketed for water cooling. The mill is driven through suitable gearing and countershaft with a 60 h.p. slip-ring motor. The drive from the motor to the mill countershaft is a Link-Belt silent chain drive.

The Hardinge mill carries a 12,800-lb. charge of flint pebbles, consisting of sizes from 5-in. down to 2-in. The mill operates at 27 r.p.m., and the feed runs about as follows:

| | |
|---|---|
| Through 1-in. ring | 100% |
| Through 2-mesh | 89.9% |
| Through 4-mesh | 61.8% |
| Through 12-mesh | 43.8% |

The moisture in the feed averages about 2 per cent, although it has run as high as 6 per cent in winter seasons. Under conditions where moisture runs consistently over 2 per cent a rotary silex-lined coke-fired dryer would pay for itself in a short time, due to increased capacity of the grinding unit when operating on dry material. In the case of the Golding Keene Co., it was planned to carry material under storage sheds over the winter months, thus insuring reasonably dry material to the mill at all times.

The product from the Hardinge mill is lifted by another bucket elevator to a 14-ft. "Gayco" air separator. The mill product or feed to the air separator runs about as follows:

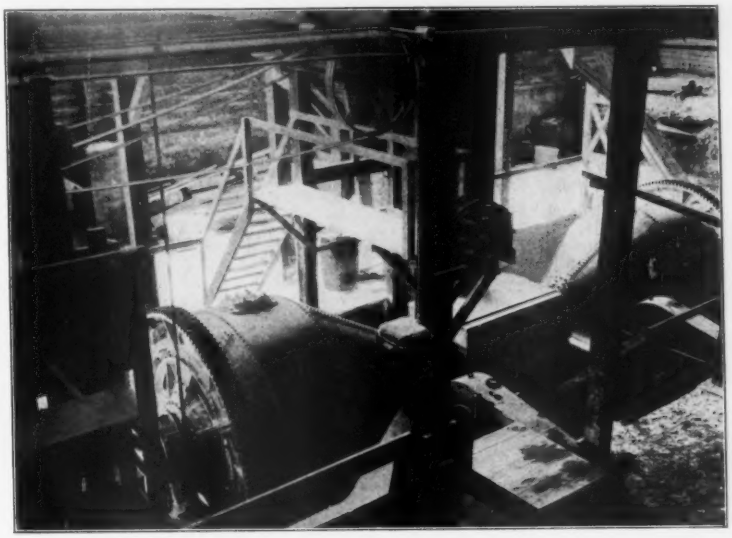
| | |
|---|---|
| Through 140-mesh | 70 to 80% |
| Through 200-mesh | 55 to 60% |
| Through 300-mesh | 40 to 50% |

while the finished product coming from the air separator averages as follows:

| | |
|---|---|
| Through 140-mesh | 99.8% |
| Through 200-mesh | 96 to 98½% |
| Through 300-mesh | 91 to 92% |

The capacity of the Hardinge mill and air separator delivering this product is 2700 lb. per hour and at times when material is unusually dry (thus showing advantage of drying), runs up to 2 tons per hour. The coarse tailings from the separator are discharged onto a belt conveyor which returns them to the feeding table ahead of the mill.

The "Gayco" air separator consists briefly of an outer shell with separating chamber, tailings cone, baffle plates, feed pipe on which are attached the fans, driving mechanism enclosed running in oil, and distributing plate. The main fan causes a lifting action while the small fan in the separating chamber causes a centrifugal separation. By various adjustments such as removing the concentric plates on top of the inner separating chamber and removing fan blades on the centrifugal fan, the resultant of the two forces lifting and centrifugal can be varied to obtain almost any fineness of product desired, which is little affected by atmospheric changes or variations of feed.



***A recent Hardinge mill installation showing a pair of mills with common discharge spout***

The finished material is discharged to a belt conveyor, which feeds directly into box cars or into an elevator which in turn lifts the material to a storage room.

The "Gayco" air separator operates at a fan speed of 160 r.p.m. and consumes about 10 h.p., the elevators and conveyors take about 10 h.p., while actual readings on the Hardinge mill show that it is using about 55 h.p. The entire installation with crusher consumes about 90 h.p.

Shortly after the start of the initial installation and due to its successful performance, the Golding Keene Co. installed two 8 ft. diam. by 48 in. cylinder Hardinge pebble mills. These mills were 12 in. longer in the cylinder, otherwise the same throughout as the 8 ft. x 36 in. mill. They take a 14,000-lb. pebble charge, and operate on about 70 h.p., turning out 1¾ to 2¼ tons per hour of finished material. Another jaw crusher and 14-ft. "Gayco" separator were installed so that three mills are now operating in conjunction with two air separators.

As a result of the successful operation of this plant, a number of other feldspar and flint grinding concerns equipped their plants with this system. The advantages over the batch system are the facts that less labor is required, power per ton is considerably less, and repairs minimized. A great saving in power is also noticeable over tube mill operation. The one big advantage is, however, the fact that the product is absolutely uniform, due to positive regulation regardless of varying conditions of feed and moisture. The same is not true of batch or tube mill operation.

The same kind of an arrangement is also being used for the grinding of limestone, phosphate rock, coal and other industrial materials. In this field, it is of course advisable to use the conical ball mill in which the material is ground with steel balls against a metallic lining as a slight iron contamination is usually not detrimental in the finished product as it is in the materials like feldspar and silica, which are used in the ceramic arts. The conical mill lends itself readily to this process of closed circuit grinding, due to its conical shape, which allows higher circulating loads, resulting in high tonnage of finished product on minimum power consumption.

## New Type Secondary Crusher

By C. S. Darling
Pennsylvania Crusher Co., Philadelphia, Pa.

The year 1923 has been notable in the advance made in the dependability of the secondary crushing units installed in cement plants. Steel frame construction with tramp-iron protection has been greatly in favor among cement plant operators for the heavy duty hammer mills installed. While not new, steel frame construction and thorough dependability have received a big impetus through the development and successful operation of the heavy "Super" series of "Pennsylvania" hammer crushers.

The hammer crusher for secondary reduction in a cement plant takes the limestone and cement rock as it comes from the primary crusher, running in size up to 10 in. and 12 in., and in some cases to 18 in. and 20 in., and reduces it to 1 in., ¾ in. and sometimes as fine as ½ in. in a single operation.

Few pieces of apparatus in a cement plant get more severe usage than the hammer mill on the heavy secondary reduction. Running a peripheral speed of nearly two miles a minute, the massive rotor of such a unit hurls the stone with tremendous force against the breaking blocks of the machine, and to withstand such impact year in and year out without frequent breakdown requires the sturdiest construction and the strongest materials.

Steel frame construction is not new. In the Lehigh Valley district is a steel frame hammer crusher, one of the earliest ones, which has been operating continuously 20 to 24 hours daily for nearly 13 years without a spare, an equivalent of 25 to 30 years on a 10-hr. a day basis. The past year, however, has borne greater testimony than any other, perhaps, of the preference of cement plant officials for this type of crushing equipment. A new cement plant in the Central West commenced operations in the spring with its "Pennsylvania Super," taking the entire product of the primary and crushing every pound of rock for cement making, with no provision for a spare.

At about the same time one of the new plants in the South started operation with its "Pennsylvania Ajax," similarly crushing all the rock for this new plant. Early in the year an eastern cement company started operating its new steel frame crusher. A new plant building in Ohio has installed two "Ajax" type steel frame hammer crushers, one on limestone and one on shale.

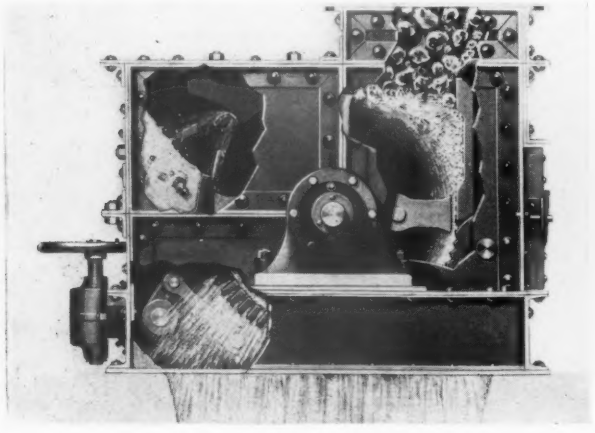
At a rebuilt Mid-West cement plant a "Pennsylvania Thor" 10 is being installed, while a Canadian cement manufacturer has arranged for the installation of a "Super" and a "Thor" in two of its plants after experience with both the steel frame construction and the other types. A "Super" 12 will be installed at a new cement plant now under construction in Canada.

An Eastern cement manufacturer will utilize a "Pennsylvania Samson" 47 of the top running type for a reduction to ½-in. and finer.

A similar tendency toward steel frame machines in the smaller sizes for crushing agricultural limestone, burned lime, gypsum, and other similar products has also been noted. A simple but effective agricultural limestone plant consists of a top running hammer crusher and an electric screen.

These frames are all of heavy steel plate and structural shapes, amply reinforced, with massive bearing girders, and are usually lined throughout with manganese steel. They are fully protected against damage from tramp iron in the feed by a patented tramp iron pocket. A deflector is so arranged that pieces of iron, steel, or other uncrushable material will be directed into and retained in this pocket.

This tramp-iron pocket, together with the massive steel construction and other features of strength and protection, make for long life and uninterrupted service. These are points of prime importance in reducing the cost per ton of limestone crushing, and explain the tendency of 1923 toward this type of machine.



*New Pennsylvania hammer mill with separator for tramp iron*

*New "Super" series of Pennsylvania hammer mill*

## Changes in the Grinding and Separation of Hydrated Lime

By W. A. Koren
Raymond Bros. Impact Pulverizer Co., Chicago, Ill.

The past year to year and a half has seen one decided change in the grinding and separating of hydrated lime. The most used method for handling this material between the hydrator and the finished product bin is a Raymond pulverizer equipped with air separation. No great amount of pulverizing takes place as the lime when it comes from the hydrator is already a fine powder, but it contains impurities, like core, sand and unburnt material. To separate this the pulverizer is operated at a low speed simply to give sufficient hammer action to knock the good, fine lime free of these impurities. The impurities are then separated from the grinding chamber as a waste or secondary product. The fine material is air separated into a uniform powder and delviered by the same fan used for air separating direct to a storage bin.

This method has been in use by nearly 90 per cent of the manufacturers of hydrated lime in the United States. It is the only method by which a high grade chemical lime can be made. In this connection it might be stated that we have run into quite a demand by a number of our customers for an extremely fine lime, practically free of all grit and impurities. This lime is evidently used quite extensively for water purification and any appreciable amount of grit causes excess wear on the pumps and other equipment.

The new development is to grind all of the lime including the impurities to a fine powder where the lime is mostly used for building purposes, the object being to save the small percentage of material which was formerly being wasted or used as secondary product. For this purpose we supply our roller mills which will grind the impurities to a sufficient fineness that will prevent all chances of the lime "popping" when used in wall plaster. The only drawback to the grinding of the impurities in with the lime is to reduce the sand carrying capacity, and the individual lime manufacturer must determine for himself whether this factor offsets the advantage of saving the impurities which would otherwise be thrown away.

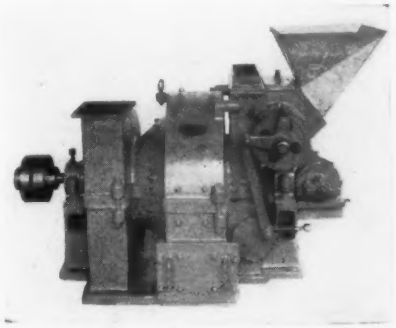
The Raymond equipment has proved it-

self capable of making any grade of hydrated lime that is wanted.

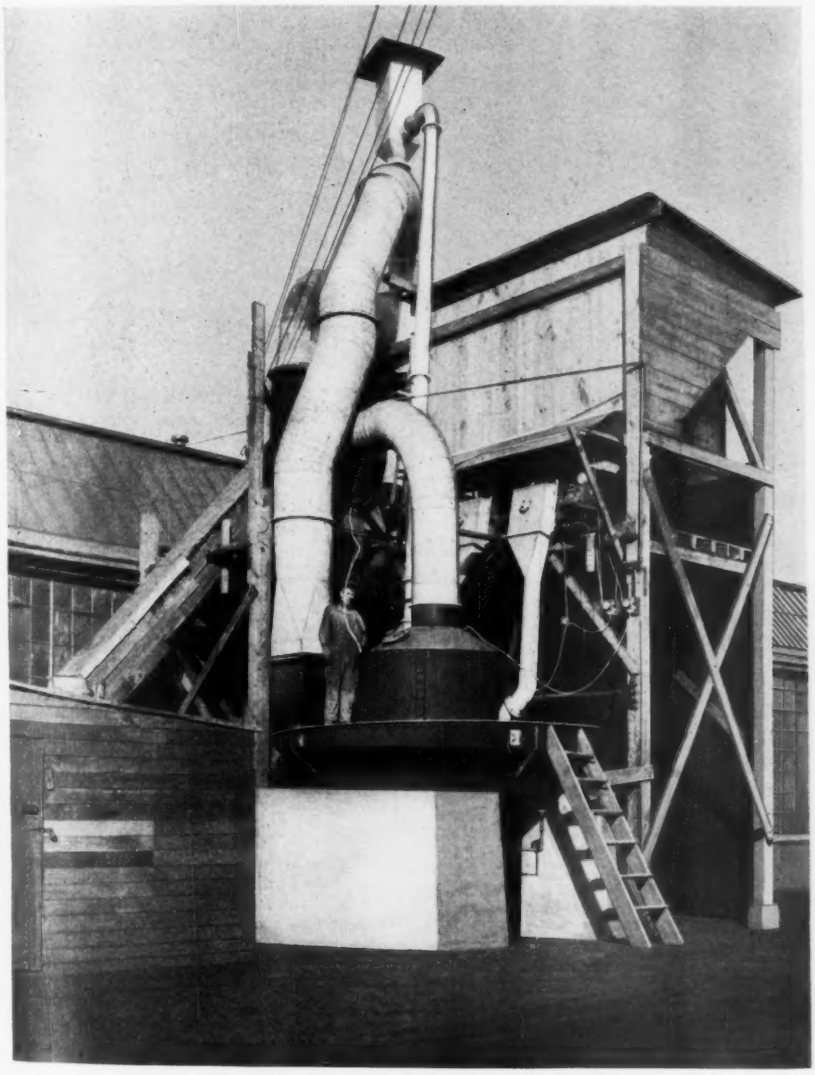
It will not be amiss to mention here two new lines of Raymond equipment which have been in the course of development during the past two to three years. One is an enlarged roller mill giving from two to three times the capacity of our present largest 5-roller machine. The principle of this new roller mill, which is called the "Ray-Monarch," is exactly the same as our present roller mills. Quite a number of changes in design have been incorporated as a result of our own experience with the present machines and these changes have materially improved the mill giving larger capacity for the amount of power employed.

The mill was designed principally because of the great demand for larger coal grinding equipment in the large power generating stations. We have erected one of these mills here at our shops and thoroughly tested it. It shows a capacity on the average grade of bituminous coal of better than 15 tons per hour to a fineness of 90 per cent or better passing a 100-mesh, with an expenditure of 225 to 230 h.p. for mill and fan. The machine is also applicable to large capacity production of limestone, phosphate rock and similar materials.

The second development is a complete line of unit pulverizers called the "Imp." These were developed because of a large demand for small coal grinding equipments which would take coal as received at a plant, grinding it to a powder and discharging this directly into the furnace.



*New Raymond "Imp" type pulverizer*



*New "Ray-Monarch" type of pulverizer and air-separation*

At present these machines are built in five sizes giving a range of capacity from 500 lb. per hour to 6000 lb. per hour, depending upon the coal to be ground and the fineness required.

Small unit machines of this type have been manufactured for a number of years, but they were never developed to the point where they could be adjusted to produce practically any fineness required. This new line of "Imp" pulverizers can grind as coarse as 30-mesh or be adjusted to as fine as 99 per cent passing a 100-mesh.

We have found that they are not only applicable to the grinding of coal, but also will be suitable for many other materials. They are built on the swing hammer principle, giving unusually large production for the power required and the cost of repairs will be appreciably lower than has ever been obtained by high speed hammer mills.

## Amsco Buys Denver Foundry

THE Queen City Foundry Company of Denver has been purchased by the American Manganese Steel Co., and plans are being made to increase the capacity and modernize all equipment to produce manganese steel castings under the Amsco patents and processes.

The personnel of the Denver management will comprise J. M. Blake, metallurgist, who will be general manager, and Kenneth Jensen, manager of sales. Mr. Jensen has represented the company for several years as traveling sales engineer. Mr. Blake will be remembered in the inter-mountain states by reason of the numerous experiments and tests successfully conducted by him with various alloy steels.

In addition, the American Manganese Steel Co. will be represented in Utah and eastern Nevada by Landes & Company of Salt Lake City, Utah; in New Mexico and Arizona by Herbert B. Wolcott, Jr., of El Paso, Texas, and by the A. T. Herr Supply Company of Denver in the state of Colorado.

## Wiggim Crushed Stone Plant Sold

SALE of the Wiggim Crushed Stone and Sand Co., at Germantown, Ohio, owned by Elmer H. Wiggim and Frank Tejan, for $100,000, has been announced.

T. D. Van Camp, head of the Van Camp Stone Co. of Cincinnati, is one of the purchasers. Greenville parties are also said to be interested in the negotiations.

The transaction includes the stone and sand plant of the firm and about 100 acres of land, adjoining the plant. The plant is located along the Cincinnati and Northern Railroad. The Wiggim Co. has been in existence about five years. Owing to ill health, Mr. Wiggim, with his partner decided to dispose of the business. Tejan will continue in the general road contracting business.

It is announced by officials of the new company that a general program of expansion will be carried out at once. The annual output of the firm is to be increased.

# Improvements, Conveyors and Elevators

OVERCOMING friction and resistance in long belt conveyors has received considerable attention from manufacturers during 1923. This is in line with the competition among manufacturers everywhere for machines not merely to replace or save labor, but to save power as well.

## Important Developments in Material Handling Equipments

By H. L. Goddard
Jeffrey Manufacturing Co., Columbus, Ohio

A number of important developments in the design of material handling equipments have been accomplished during the past year by Jeffrey engineers.

The developments illustrated and described here pertain particularly to their application to the rock products and construction field.

Jeffrey engineers are constantly experimenting and striving for developments which will aid labor to carry the heavy loads, reduce handling costs and at the same time maintain American living standards.

### *Heavy-Duty Bucket Elevators*

A very important achievement for material handling is the new Jeffrey chain for heavy elevators.

Jeffrey heavy duty bucket elevators are successfully handling ore, stone, cement, clinker, in capacities up to 700 tons per hour. The success of these elevators is largely due to the high quality and unique construction of the chain. The chain is a bushed knuckle construction very similar in design to that of the double-bushed type. This hardened steel knuckle is used to withstand the driving action of the sprocket teeth as well as the enormous crushing action between the chain and sprockets.

Referring to Fig. 3 it will be noted that the possibility of the chains parting at the joint due to wear of bushings is eliminated as the through rod which is protected against wear by the hardened bushing passes through all four side bars of the chains.

To replace a bucket it is necessary only to remove the cotter pins which pass through the innner bushing and the through rod, withdraw the through rod and drop out the bucket.

Taking out a bucket can be done without disturbing the chains the least bit, as the inner bushing serves as a hollow chain pin.

The load of chain and buckets is carried on large diameter self-oiling rollers spaced midway between the chain joints assuring minimum operating friction.

This type of chain operates over renewable chilled tooth sprockets so constructed that a complete new set of teeth may be installed without removing the chain from wheel.

### *Hercules Chain Designed Especially for Hard Service*

No. 111 Jeffrey "Hercules" chain has extra metal added where the barrel comes in contact with the sprocket tooth. This greatly increases the life of the chain.

This extra metal feature combined with the square shank pin construction makes a practical chain for elevators and conveyors handling gritty materials.

The square shank pin is held rigidly in the side bars, thus distributing the wear to the long wearing surfaces of the solid links.

The barrel of the chain contains a cavity that can be filled with graphite grease for conditions that necessitate a self-lubricating chain.

### *Self-Propelled Portable Bag Stacker*

The Jeffrey bag stacker is a self-propelled portable machine especially designed for the piling of heavy bags of cement, plaster, etc. This self-propelled stacker raises and lowers its boom by power, runs the conveyor by power and is reversible in every way. The boom can be raised and lowered, the stacker can be run forward and backward and the conveyor run up or down with motor in one position or the motor can be reversed so there are two methods of reversing all the motions.

Stacker is designed to use gasoline engine when necessary, so reversing clutches are applied to all driving shafts. It has a capacity of 500 bags per hour.

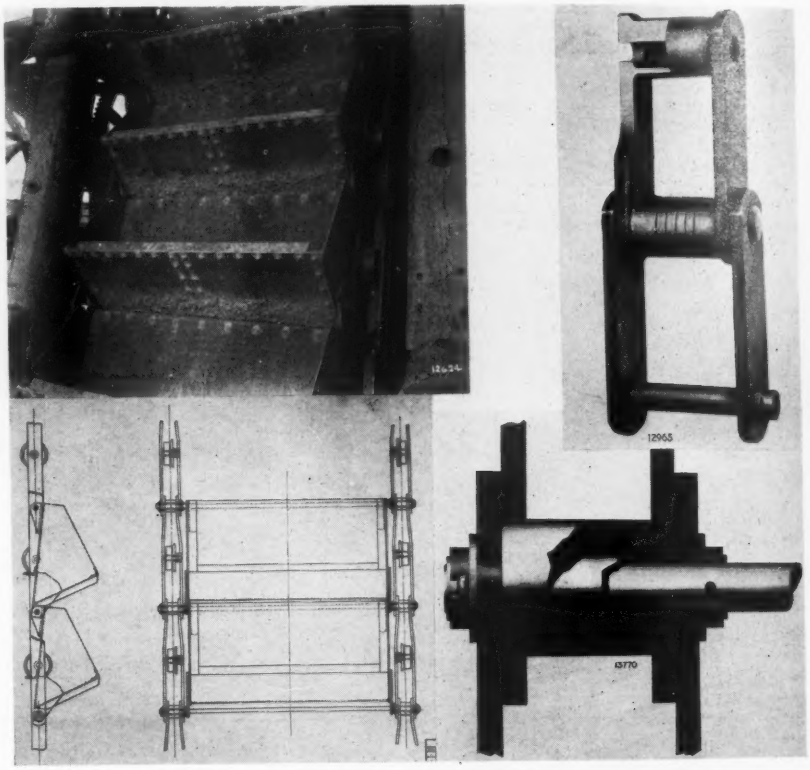
The conveying unit operates at a speed of 50 ft. p. m. for a capacity of five hundred 325-lb. bags per hour to a maximum height of 25 ft. When in the maximum position the tip of the boom overhangs the pile about 11 ft.

This new stacker propels itself backward and forward at about 100 ft. p. m. and is provided with an automobile type steering gear, allowing the machine to be handled very easily in confined spaces.

All the controls are brought to one point. The levers for the various reversing clutches, the controller and switches for the motor are all brought out to one side of the machine so a man in one position can perform all the operating functions without moving around.

The upper boom is raised and lowered by means of a telescoping leg operated by a series of sheaves and wire cable. A power for conveying, raising and propelling is supplied by a 5 hp. motor at 1140 r.p.m. through a Morse silent-chain drive to a Kinney type friction clutch mounted on the same shaft with the reversing miter gears. Power can be taken through the gears to operate either the raising, lowering or propelling mechanism.

The stacker with the boom in the lower position stands about 6 ft. 6 in. high with a maximum width of 5 ft. 4 in. and wheel base of about 8 ft. By reversing the motor the stacker can be used for breaking down storage piles.



*Figs. 1, 2, 3 and 4 showing details of new Jeffrey heavy duty bucket elevators*

### *Portable Belt Conveyor*

The Jeffrey portable belt conveyor is a strong, light weight machine for general service. It is designed to meet the demand for a light, durable, and inexpensive conveyor for loading sand, gravel, crushed stone, etc.

The capacity of the Jeffrey portable conveyor runs from 20 to 50 tons per hour. It depends a great deal on the kind of material handled and the type of men operating the conveyor.

### *Roller Bearing Belt Carriers*

Where economy of power consumption is

*Fig. 5—Self-propelled portable bag stacker*

*Fig. 6—Uses gasoline motor or electric power*

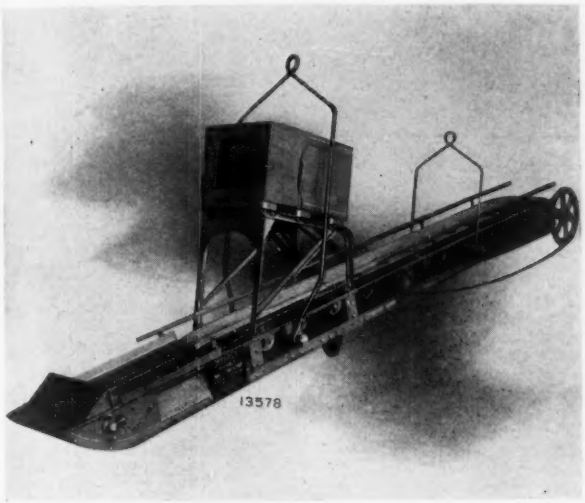



*Fig. 8—Portable belt conveyor*

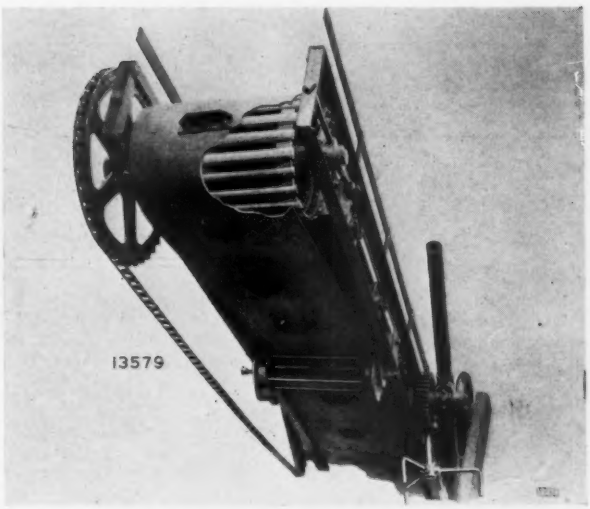



*Fig. 9—Another view of new portable conveyor*

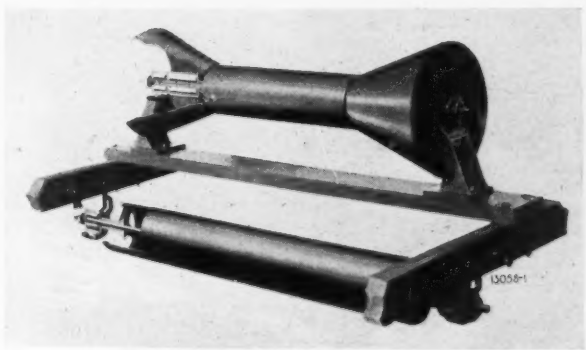


*Fig. 10—Roller bearing belt carrier*

*Fig. 11—High pressure lubricating system*

an important factor, the new Jeffrey concentrating carrier is well adapted.

This idler made of double cast iron cones and a steel pulley, is equipped with Hyatt roller bearings and high pressure lubricating system.

A great saving of power is due to the few bearings used and to the anti-friction bearing construction.

Being of rugged construction this concentrating idler is particularly adapted to the handling of stone, sand, gravel, ores, etc.

### *Belt Conveyors Equipped with High Pressure Lubricating System*

Thorough lubrication is playing an important part in the mechanical handling of materials; it gives positive assurance of increased life and noticeable saving of power.

One of the most important units that have proven difficult in the past to thoroughly lubricate is the belt conveyor with its series of pulleys on hollow tubes. By this new method of lubricating, the tubes are first packed and then any additional pressure forces the lubricant out through the holes in the wall of the tubes to the working surfaces.

The explosive action of this high pressure

system gives assurance that the center idler receives its quantity of the lubricant as well as the end ones. Having the tube packed with lubricant then after working up pressure in the gun the nozzle is thrust into the fitting; this automatically releases the pressure stored up in the gun and instantaneously jolts the packed lubricant with a blow of tremendous force, driving lubricant out through every available opening. The grease in being driven out by this explosive action carries with it the gritty and dirty particles harmful to the working surfaces and also opens up any clogged passages.

The system is quick and clean to operate —no complicated nozzle locking device for attaching gun to fitting—no easily lost dust cap.

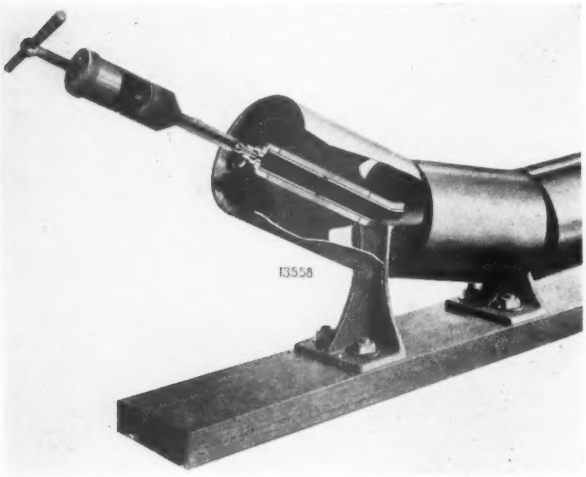



*Fig. 12—Showing mechanism of lubricating system*

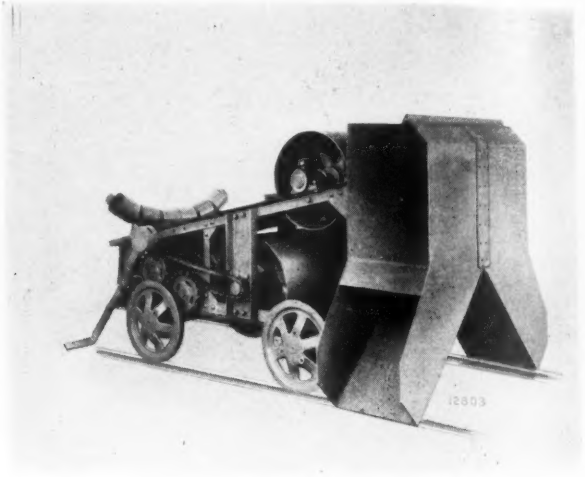



*Fig. 13—New light belt tripper*

### *Light and Inexpensive Belt Tripper*

The demand for a light and inexpensive belt tripper developed the design illustrated in Fig. 13.

Jeffrey belt trippers are of structural steel construction, light but rigid. They are made in two types, hand-propelled and self-propelled—automatic reversing.

The hand-propelled is used where it is desirous of discharging the load at various points from time to time. The self-propelled—automatic reversing is used where a uniform distribution of the material from a given portion of the conveyor is desired.

The self-propelled tripper is equipped with self-contained drive jack propelling the tripper through disc type friction clutches thus assuring an easy stopping and starting as the tripper reaches the end of its run. After starting it will move regularly back and forth without further attention.

## Increasing Demand for Portable Belt Loader

By P. H. Phillips

Ottumwa Box Car Loader Co., Ottumwa, Ia.

Our box car loader is the result of many years' practical experience. It is finding an increasing use in the rock products industry for handling lime, sand, limestone, etc. During 1923 we made eight or ten new installations in this field and from reports received we believe that our loader will continue to be a labor saver in many rock products plants.

The loader is easily and quickly wheeled by one man into center of car, height of end of conveyor adjusted to suit car, motor or engine started and loading commences. No more attention is necessary until first end is completely loaded when the loader is simply swung around to point into the opposite end. The operator may attend to other work while loading proceeds. When car is loaded, loader is wheeled into next car. The power driven conveyor belt easily throws the material into the end of the largest car.

Our loader is designed to reduce loading cost to a positive minimum, to operate with the least possible power consumption, to move from place to place with the greatest ease, to be the most simple to inspect and repair and to last for many years. It has not been in any way cheapened, instead nothing but roller and ball bearings have been used throughout, the latest improved "Alemite" greasing system takes the place of oiling, rollers are provided to carry the weight of the belt and the material, instead of permitting it to drag on a flat surface, and it has been provided with a novel and efficient raising and lowering device that makes it adaptable equally well to every size car.

## Big Demand for Wire Screen Cloth

By A. A. Campbell

Newark Wire Cloth Co., Newark, N. J.

The Newark Wire Cloth Co. during the current year has more than tripled the capacity of its plant, having purchased outright the entire business of the Morss & Whyte Wire Cloth Co. of Cambridge, Mass., which has been in the oil-cloth business over a century, and also a large amount of the heavy machinery of the Rogers Wire Cloth Co. of Belleville, N. J. These, combined with the equipment of the Newark concern, has made us second to none and the only manufacturer in this country manufacturing from the finest to the coarsest wire cloth made. This has been, we believe, the outstanding achievement of the business. It has been necessary to construct a new building and the entire plant has been removed from seven smaller buildings to one large building 100 ft. by 310 ft. Up to January 1, 1923, Newark Wire Cloth Co. manufactured very little wire cloth over 40-mesh. Today, we think nothing of shipping car load lots of meshes ranging from the finest grades to wire as stiff as boards. A considerable amount of the material is being used in the rock products industry, as we are furnishing cloth to manufacturers of road machinery, cement plants, sand and gravel companies, testing laboratories, mines, etc. In addition, development is under way for the manufacture of a non-corrosive alloy wire cloth which can be manufactured at a price not prohibitive. This is known as Master Metal and great things are looked for along this particular line.

## Will Build Fluorspar Concentrator in New Mexico

MIKE KENNEDY, millwright and engineer, has been engaged by Frank Merrill, manager of the Nakaye Fluorspar Corporation, to build a 200-ton fluorspar concentrator near Derry, N. M. Water will be pumped from the Rio Grande river to the mill. The mine is two miles further up in the high hills and the ore will be hauled or trammed to the mill from the mine. This mine has been working more or less steadily for four years. It is unique among New Mexican fluorspar deposits, in that it is a flat-lying blanket deposit in fossilized limestone; it covers the top of a low range of barren mountains.

## Slate Meeting in New York Jan. 21, 22, 23

THE National Slate Association announces that the Slate Industrial Conferences will be held at Hotel Commodore, New York, Jan. 21, 22, 23. Two new members of the National Association are recorded, the Belfast Slate Co. of Nazareth, Pa., and the Atlas Marble & Slate Co. of New York.

Slate quarry and mill managers are requested to send in estimates of sales of 1923 to the U. S. Geological Survey at once in order to have as complete returns as possible to present at the conference.

# Developments in Screening and Separation

WE HAVE ALREADY noted a number of recent improvements in screening and separating devices under the heading "Crushers and Pulverizers." What follows is in the nature of a supplement to that:

## Dewatering Classifier

By P. E. Van Saun
Kennedy-Van Saun Mfg. & Eng. Co., New York City

In the washing, classification, and dewatering of coarse and fine sand, our dewatering classifier has solved the problem of efficient washing of large tonnages. This machine, in the balanced duplex type, has been made of all steel construction for the members taking principal stresses, so as to increase its strength and rigidity for heavy duty. Its action results in progressively turning over the material, thus giving a most thorough washing and subsequent draining. It may be used, when desired, to separate coarse concrete sand from fine plaster sand in the one machine thus giving two distinct washed and drained products. This classifier is eminently suitable for classifying pulverized ores, and in wet process cement plants, for returning oversize in slurry grinding.

## "Telsmith" Screens and Sand Tanks

By Charles F. Smith
Smith Engineering Works, Milwaukee, Wis.

Two important improvements have been made in the design of "Telsmith" rotary screens and gravel washers: (1) High carbon steel rollers instead of chilled iron. (2) Instead of a one-piece head ring, made of chilled iron, we have substituted a head ring made in two pieces. The part subject to wear; viz., the tracker ring, is made of high-carbon steel. This part of the head-ring is comparatively light, simple and inexpensive to replace.

We call particular attention to the "Telsmith" improved settling tank. This is the first tank ever offered to the gravel washing trade which will really de-water its product thoroughly. It is likewise the only tank that is really automatic. Both of these advantages are traceable back to one feature in the construction of the tank. As the sand accumulates, so as to cause a change in the center of gravity, the hopper tilts in one direction, while the valve plate pivots in the opposite direction. Consequently, a substantial amount of material can be discharged with a very slight movement.

## Improvements in Air Separators

By Rubert M. Gay
Rubert M. Gay Co., New York City

The modern air separator is so designed that it can easily be adjusted to cover the entire range of fine separation from 60-mesh to 350-mesh; is not affected by variations in speed or rate of feed and is entirely self contained, being more easily installed than a screen. As these machines require no attention other than filling an oil tank once a week; use but little power and deliver a product that is of uniform fineness day after day, they have made possible the recovery of valuable products from otherwise waste material.

In crushed limestone plants the screenings contain a large amount of dust which when separated bring a good price for agricultural purposes, asphalt filler, paint filler and many other purposes.

When slate granules are manufactured about one-half of the material quarried is fine waste which when separated usually yields about 50 per cent saleable dust. Some manufacturers have installed grinding mills and reduce all of this waste to commercial slate flour.

In the feldspar industry the past year has shown a startling change in the methods of grinding this material for the ceramic industry. For years spar and flint have been ground in batch mills, a charge being placed in the mill and ground for a number of hours, the mill stopped, a sample taken and tested; if not sufficiently fine the mill was run for an hour or two longer and another sample tested. This method could not be depended upon to give uniform products and the spar grinders were quick to realize the advantages of continuous grinding and sizing with the centrifugal type of air separator which handles this material without contaminating it with iron and delivers a product to exact specifications.

During the past year some nine or ten spar grinders have installed this new type separator and today practically all of the important grinders are equipped with these machines.

In the fibrous talc field one of the largest grinders has installed three of these machines in the past twelve months (making six in all) and reports that he is turning out the finest commercial ground material ever produced, running 100 per cent through 325-mesh.

Some of the materials for the separation of which centrifugal air separators have been installed within the past year are coal, shale, tripoli, bauxite, barytes, graphite, garnet, silica, slate, talc and cement clinkers, as well as many materials outside of the rock products industry, such as wood-flour, carbon black, iron oxide, chemicals, etc.

From the above it will be noted that "Air Separation" has solved the problem of fine grinding and its use is rapidly becoming universal throughout the industry wherever fine products are required.

## Magnetic Separators

By R. A. Manegold
Dings Magnetic Separator Co., Milwaukee, Wis.

PERHAPS in pointing to a certain installation in a large magnetic iron ore concentrating plant in the East, where magnetic pulleys have been installed, the principles of operation are best illustrated. We have picked an installation which represents an initial investment of from $8000 to $10,000 and which paid for itself in from 60 to 90 days. The facts are that this mining company for many years mined iron ore at the rate of 1000 tons per day. It was all crushed to pass ⅜-in.-mesh and at which point the concentration started. The process of concentration involved special agitating drum type machines as well as concentrating tables, and with the old method, in addition to crushing all the ore to pass ⅜-in mesh, sufficient concentrating machinery was installed to handle that feed.

Tests were conducted, and it found that a magnetic pulley, 30 in. diameter, extracted all ore which had an iron content of 2 or 3 per cent and higher. Also that 30 per cent of the mill's feed could be rejected imme-

*New Dings magnetic attachment for revolving screens*

diately without further crushing or treatment in the plant. To be sure, a loss of 2 or 3 per cent in iron on these coarse sizes amounted to something, but as compared to the cost of crushing from 1½-in. down to ⅜-in., it is readily seen that the small loss of iron as compared to the crushing could be disregarded. It takes a very powerful magnetic pulley to extract a piece of rock with only 2 or 3 per cent of iron included.

The increased demands from quarries, cement plants and gravel pits for magnetic protection to their crushers, has brought about the design of a magnetic attachment to their revolving screen. We have found that older plants' designs does not provide for the magnetic separation of iron, and it is difficult in many cases to find room for the proper equipment.

Every plant has a revolving screen, and the magnetic attachment consists of attaching to the discharge end of the screen a blank surface of manganese steel, non-magnetic sheet. Attached to the inside of this section are auxiliary magnets of soft permeable steel.

***Screen Magnetic Separators***

A semi-circular magnet, as shown, encircles the non-magnetic blank portion of the screen, half way around, and the deleterious iron which always comes with the oversize, when this iron reaches the magnetized zone, it is firmly caught and held and carried up and away by the revolving screen to a point, when in being carried out of the magnetic influence, it drops into a chute provided. The accompanying illustration shows the non-magnetic section which is attached to the discharge end of the screen, as well as the semi-circular magnet. This happens to be an illustration of one of these attachments suitable for a 5-ft. diameter trommel.

The advantage of the attachment just described lies in the fact that very little additional room is required. The trommel over all dimension is not made longer by over 2 ft. and this attachment has advantages also in that it can be attached to equipment already installed and it is far less expensive than a large magnetic pulley installed as a head-drive pulley on a conveyor belt.

# Calcining Machinery and Accessories

THIS IS a branch of the industry that has witnessed no striking developments in 1923. There are, however, some experiments underway in lime-calcining equipment which are likely to lead to important results.

## Cement Kiln with Two Riding Rings

By Lewis A. Rice
Traylor Eng. & Mfg. Co., Allentown, Penn.

Although we have sold a number of kilns during the past year we cannot claim any novelty for our kilns, except that they are built along the lines of all Traylor equipment, heavy and rugged enough to stand the extremely hard service which rotary kilns in cement plants are subject to. The New Egyptian Portland Cement Co., Port Huron, Mich., have in operation one of our 11x200-ft. kilns supported by two riding rings. This, so far as we know, is the only kiln of this size supported on two riding rings.

## Progress in Gypsum Calcining

By R. Lowe
Butterworth & Lowe, Grand Rapids, Mich.

The small 6-ft. and 8-ft. diameter kettles are proving not big enough for North American trade. Kettles 10 ft. inside diameter and about 9½ ft. deep seem best. Still larger diameters have been installed, but whether they will prove most economical in the long run remains to be seen, and some of them have been replaced by kettles 10 ft. in diameter.

The best number of steel flues through a kettle is probably four, and they should be large and preferably of heavy tubing—*not* of rolled and riveted steel plates.

If the heat only passes once through the kettle we call it the "direct" type, but if the heat passes through a lower tier of steel flues and is then returned and passed through an upper tier of steel flues we call it the "return" type. In the direct type the batch can be calcined in slightly less time, but there is a waste of fuel and the destruction of the kettle itself is more rapid. When burning the same amount of fuel under the return type of kettle the temperature of gases escaping up the smoke stack is usually 175 deg. lower. This 175 deg. has been absorbed in heating (without expense) the upper tier of flues, and thus a good saving in fuel and in maintenance cost is effected at the slight cost of say 5 per cent extra time in calcining a batch. In the return type the lower tier of flues is hottest, which is an economy because less heat is wasted in the upper flues before they are (in the process of filling) submerged in the raw gypsum. Installing metal plates in place of all the fire-brick partition walls which have hitherto come against the kettle sides has proved a fuel saver and decreased the upkeep expense.

## Lime Hydrators

By H. Miscampbell
Duluth, Minn.

We have made numerous improvements in the construction of the Clyde hydrator. The arrangement of the plows has been improved so that the lime is turned over 32 times per minute while hydrating. We have added the Clyde cooler below the hydrator and ahead of the pulverizer. This is a long cylinder with a revolving shaft inside with two paddles every six inches of its length. The fourth paddle operates with a reverse motion. These paddles operate at a good speed. The material may be dumped from the hydrator more moist; as soon as the operator is certain his moisture content is right. The paddles perform some of the work formerly done by the pulverizer. The combination results in an increased capacity and an improved product.

We have made marked improvement in collecting the dust. We have developed a dust-collecting stack which collects and returns to the hydrator a large part of the dust which formerly escaped to the atmosphere. We can now furnish the Clyde plant free from dust both outside and inside.

Demands from the trade that we furnish a complete plant has caused us to ogranize a highly competent engineering force. We are now prepared to furnish a plant with buildings in either steel or wood, complete from quarry to finished hydrate, erected ready to run.

We have furnished complete plants this year from Eastern Canada to Southern California.

One of our hobbies is to so design and build that as the demand increases the necessary added units may be placed without tearing down what has gone before.

During the past year in answer to numerous calls from the Cotton Belt we have developed a method for the manufacture of calcium arsenate at the very lowest cost. The destruction of the boll weevil has been a problem which seems best solved by the application of calcium arsenate. We design and erect complete plants for its manufacture making the plant available for the manufacture of hydrated lime when not making poison.

## New Waste-Heat Boiler Installations

By S. G. Bradford
Edge Moor Iron Co., Edge Moor, Del.

We have made several modifications and designs during the past year, notably the adoption of the steel tube economizer for certain operating conditions, and a wider application of the principle of common flue. A common collecting flue is one of the outstanding features of the Edge Moor waste heat system. We have extended this to include a common fan flue by which the gases are taken from all of the waste heat boilers into a common fan flue and exhausted by one or more fans, as may be required, with the result that repairs on a fan does not mean the necessity of shutting down the boiler.

Also one of our most recent installations showed a modification in design by placing the waste heat boilers over the common collecting flue. By this arrangement there will be less tendency to carry dust into the boiler setting and consequently less trouble from dust.

Both of these improvements have been installed at the No. 4 Mill of the Alpha Portland Cement Co., Martins Creek, Pa., and while this plant is not entirely finished and operating, part of the kilns are operating on the waste-heat system with very satisfactory results.

Another feature of interest combined in this plant is the proper arrangement under the boiler setting and the chutes for carrying the dust from the bottom of the second and third passes into the fan flue. The problem of dust handling in waste-heat plants is a serious one and any arrangements made to simplify this add to the advantages of a waste-heat plant. During the current year we have closed contracts with the Lehigh Portland Cement Co. for their plant at Mason City, Iowa, and the Pennsylvania Cement Co. for their plant at Bath, Pa. Both of these plants are large ones, containing most of the recent developments in our system. Both of these have a common collecting flue which is the basic feature of the Edge Moor waste-heat system and which is a patented part of our installations and has resulted in better drafting of kilns and increasing their capacity. This common collecting flue is of course not a new development this year, but every year's use shows the advantage of this arrangement, and in almost every old plant it has resulted in an increase of capacity.

# Power and Power Transmission

IN THE POWER FIELD the big electric companies have been very active. The General Electric Co. has put on an entirely new motor—the "Super-Synchronous" motor—which because of (1) high starting torque; (2) low starting current; (3) no clutch required; (4) floor space a minimum; (5) outboard bearing eliminated; is said to have many applications in the rock products industry. Motors of this type are already operating successfully in driving tube mills in the cement industry.

## Electrical Developments in Mining and Material Handling

By T. H. Miller

Westinghouse Electric and Manufacturing Co., Pittsburgh, Penn.

The useful field of electrically operated machinery in the mining industry continues to broaden. This year has seen the completion of a new type of shovel to be used in loading copper ore at the mines. Alternating current motors are used on this shovel which has been completed and will soon be put in operation. The hoist is operated by two 80 h.p. motors and the swing by one 75 h.p. motor. The thrust is handled by a 75 h.p. motor. The control of these motors is full electro-pneumatic unit switch type similar to that used on Westinghouse locomotives. The character of service to be perfomed in this work is such as to require the most rugged type of equipment.

The largest ore transfer car was put in service during the year. This car was equipped with Westinghouse motor and control.

A "midget" storage battery locomotive for metal mines has been developed. This locomotive carries a single motor and double reduction gearing to one axle with a chain drive between axles. In order to reduce height, the battery is carried on a small trailer.

During the year three quencher locomotives with special control and equipment features have been constructed for steel mill use. There was also supplied for the same use two remote control locomotives of 35 tons each for spotting service.

## Chain Drives

By A. B. Wray

Morse Chain Co., Ithaca, N. Y.

We are furnishing drives for pumps, for different types of air compressors, for tube mills, and conical mills. One of the large users of Morse silent chains in this field is the Solvay Process Co., Syracuse, N. Y., and its allied interests. We are furnishing the American Gypsum Co. drives. Our understanding is that these go on grinding machinery. We have furnished cement mills with a good deal of equipment during the last year. Most of this has been in connection with pulverizer fuel burning equipment. The Corning Glass Co., Corning, N. Y., are using our drives for pulverizing glass sand.

## Belt Drives

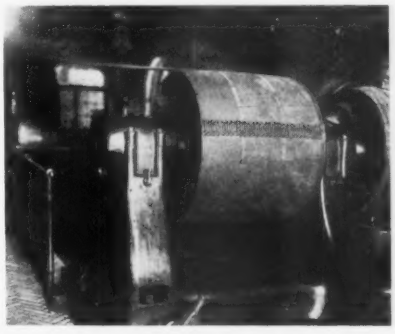
By F. D. Rich

Crescent Belt Fastener Co., New York City

As a rule throughout all industry today labor costs are high. This is true also of power. And while it is true that a better price is being obtained today for the produced product, managers are realizing that to obtain anything like the former percentages of profit it is necessary to watch the many small economies. and eliminate those invisible leaks of power and production which unless stopped easily run into large sums.

The performance of belting and belt joining is unquestionably being scrutinized with a thoroughness today that has seldom been accorded it in the past, and especially by those producers who operate on a real cost fixing basis rather than by rule of thumb.

The leaks of power and the losses of production caused through improper belting and wasteful and destructive methods of belt joining, though invisible, are nevertheless entirely real and frequently run into large sums which become tremendously evident when a breakdown occurs and a belt is destroyed.



*Crescent belt fasteners insure good drives*

It is significant that in this connection belting manufacturers affirm that nine-tenths of all belt trouble has its origin in poorly made belt joining. Belting manufacturers and also belting salesmen are focusing attention on the importance of proper joining to assure the full life and the best service of their belting. Many producers in the rock products field have checked up on their belting performance for past years and proved conclusively that it pays to join a belt in a way to maintain its maximum strength at the joint and to avoid wear against the pulleys. In this connection some interesting data is available through the research work of the Crescent Belt Fastener Co. and several of the belting manufacturers.

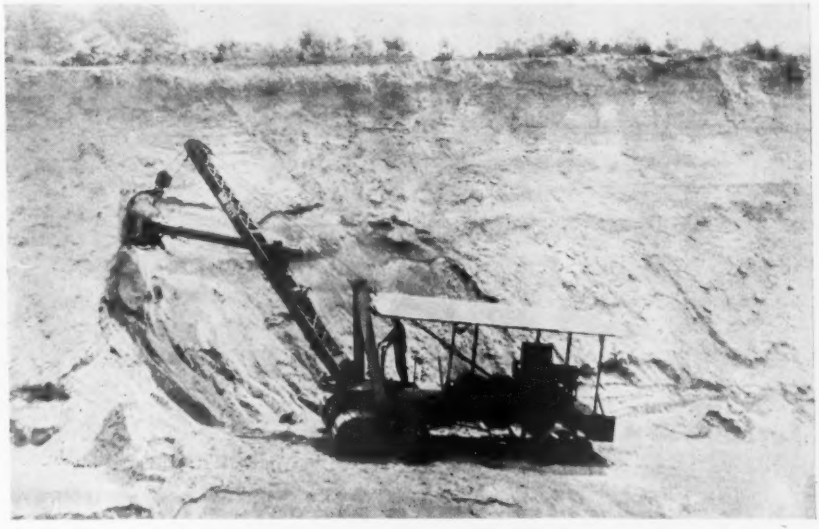
## Increased Applicability of Internal Combustion Engines to Industrial Uses

By Walter S. Peper

Climax Engineering Co., Clinton, Ia.

The internal combustion engine is winning its place in the industrial field because it has proved a reliable prime mover. The first applications to industrial machinery were engines of low horse-power, generally a single cylinder, and controlled by the hit-and-miss system of governing. These engines functioned quite satisfactorily. However, the farm and industrial tractor required an engine of greater horse-power, smoother operation and economical both with respect to general upkeep and cost of operation. Here the single cylinder could not be used because of its irregular speed and unreliability under heavy loads. Neither could the multi-cylinder marine engine be used because of the excess weight. The solution of the problem was had in the design of a specialized engine of multi-cylinder construction, medium duty type.

After the reliability of the tractor engine had become known other fields of



*New heavy-duty gas engine sand and gravel plant equipment*

industry turned toward the internal combustion engine as a prime mover. Irrigation and drainage companies hooked up gasoline engines to pumps, mining and construction companies used them to drive air compressors, etc. The capacity of the engines was immediately absorbed in this work and a demand was at once created for larger engines.

Having served the tractor field faithfully in building the Model K four cylinder, 5x6½-in. engine, the Climax Engineering Co. turned to the manufacture of a larger engine for industrial installations. After careful survey of the demands the TU engine was designed. This engine is a four-cylinder job, 5½ bore by 7 in. stroke and develops 81 brake horse power at 1200 r.p.m. This engine has been applied to electric generating sets, cranes, shovels, conveyors, elevators as well as pumps, power units, compressors, etc., of larger size or capacity. All of the installations have proven successful and from time to time other new and interesting applications were found.

During 1923 the Climax R-6, six-cylinder, 5½x7 in. engine of 120 b.h.p. was developed. This engine was designed to fill the need of an engine of smoother operation and greater horsepower to take care of such work as gasoline locomotives, stand-by electric generating sets for steam power plants and other industrial installations requiring smooth operation with considerable power. Some of the mechanical requirements of this engine are the adoption of a modified Ricardo type combustion chamber, dual ignition, and built-in governor. Unusual from common practice is the timing gear arrangement. The crank-shaft timing gear is attached at the flywheel end of the crankshaft directly adjacent to the flywheel flange. This method is to insure elimination of the destructiveness of crankshaft torsional vibrations. Accessibility has been given careful consideration so that repairs can be easily made in the field or shop.

## Wire Rope

By L. H. Gault

A. Leschen & Sons Rope Co., St. Louis, Mo.

The rigid testing of materials that enter into their product has always been of foremost importance to A. Leschen & Sons Rope Co., of St. Louis, manufacturers of "Hercules" (Red-Strand) and other high-grade wire rope.

This company has just completed a modern fire-proof structure, 308 ft. long by 77 ft. wide, in order to enlarge and improve its testing laboratory and testing facilities.

One of the interesting features of this enlarged laboratory is a mammoth wire rope testing machine—by far the largest ever erected in this country. It was built by Tinius Olsen of Philadelphia, and is capable of testing to destruction wire rope over 3 in. in diameter. Its capacity is 400 tons.

This new machine will enable the A. Leschen & Sons Rope Co. to make a double check on their already thorough method of testing. Every wire that goes into a rope manufactured by this company is first tested as to torsion, tension, elongation, etc., to make sure that it comes up to the Leschen standard. This new machine will enable them to prove definitely that each wire in every rope has been correctly twisted into the rope, and is therefore in position to assume its full part of the loads that it will be called upon to handle.

## Semi-Diesel Oil Engines

By J. Redfern

The Power Mfg Co., Marion, Ohio

One of the most modern gravel plants in the East has been recently completed by the Ballina Sand & Stone Co., at Ballina, N. Y., which is owned and operated by the McCain Realty Co. of Syracuse, N. Y.

This plant is operated by a 125-h.p. type "BU" "Primm" heavy duty semi-Diesel oil engine built by the Power Manufacturing Co., Marion, Ohio, which engine on account of the several exclusive features incorporated in this design is of considerable interest.

The "Primm" engine is entirely enclosed, being dust-proof and water-proof and is a very massive piece of machinery as will be noted from the illustration.

It is of the two-cycle design and is equipped with a crosshead so that the only appreciable wear upon the cylinder walls is that due to the tension of the piston rings, the weight of the piston being supported by the stuffing box as in a steam engine.

The engine is equipped with a patented heat compensator installed in the cylinder head which is one of the latest developments in modern oil engine practice, its function being the automatic regulation of heat available for ignition at various loads which is accomplished by the expansion and contraction of the compensator.

The fuel oil is injected into the combustion chamber in quantities regulated by the governor in six fine sprays in six different directions at right angles to the axis of the cylinder which insures perfect mixture with all of the air in the combustion chamber which is very essential and accounts for the remarkably low fuel consumption of the "Primm" engine. The entire absence of vibration in this engine is remarkable and it starts very easily.

## $1,500,000 Talc Company

ARTICLES of association have been filed with the Vermont secretary of state for a corporation with a capital of $1,500,000, the Eastern Magnesia Talc Company, Inc., with headquarters in Burlington.

This is not the largest corporation in the state, but it is unusual to have so large an amount of capital applied for at the start. Most companies increase the capitalization gradually.

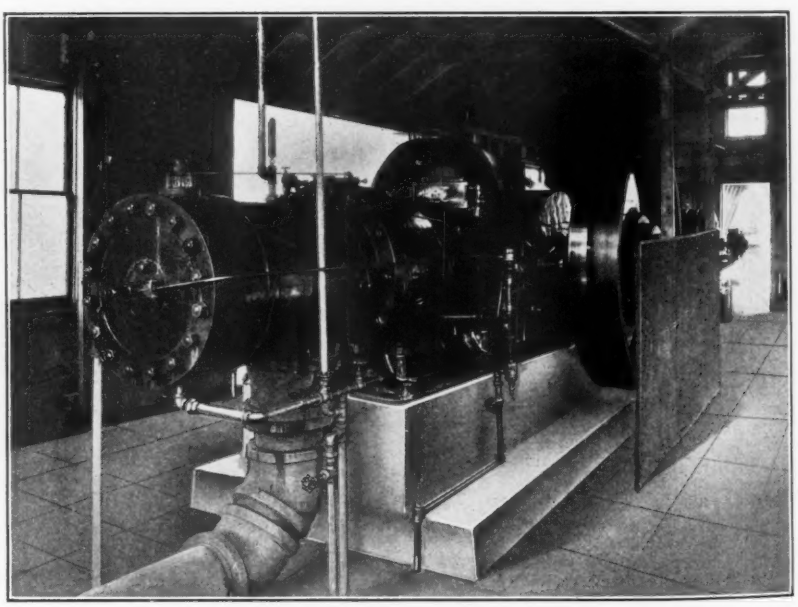
One of the talc mines to be operated is now being worked in Waterbury. The purposes of the new company are many; to mine, manufacture and deal in talc and mineral pigment.

The incorporators of the new talc company are Freeland Jewett of Boston, Mass.; J. Colby Bassette of Boston; Sherwood E. Hall of New York City; Warren R. Austin, John S. Patrick and Roy T. Patrick of Burlington, Joseph T. Smith of Waterbury, and Ned E. Pease and Edward C. Mower of Burlington, executors of the estate of Elias Lyman, late of Burlington.

## A. F. Miller to Build New Peerless Cement Plant

PLANS are being completed and construction will soon be started on the new plant of the Peerless Portland Cement Co. on the Rouge River at Detroit, announcement of which was recently made.

A. F. Miller, consulting engineer of Detroit, is doing the engineering work and will supervise the construction. Mr. Miller is very well known in the cement industry. He was engineer of the Trinity Portland Cement Co.'s plant at Dallas, Texas, and supervised the construction.



*Semi-Diesel oil engine at the Balling Sand and Stone Co. plant*

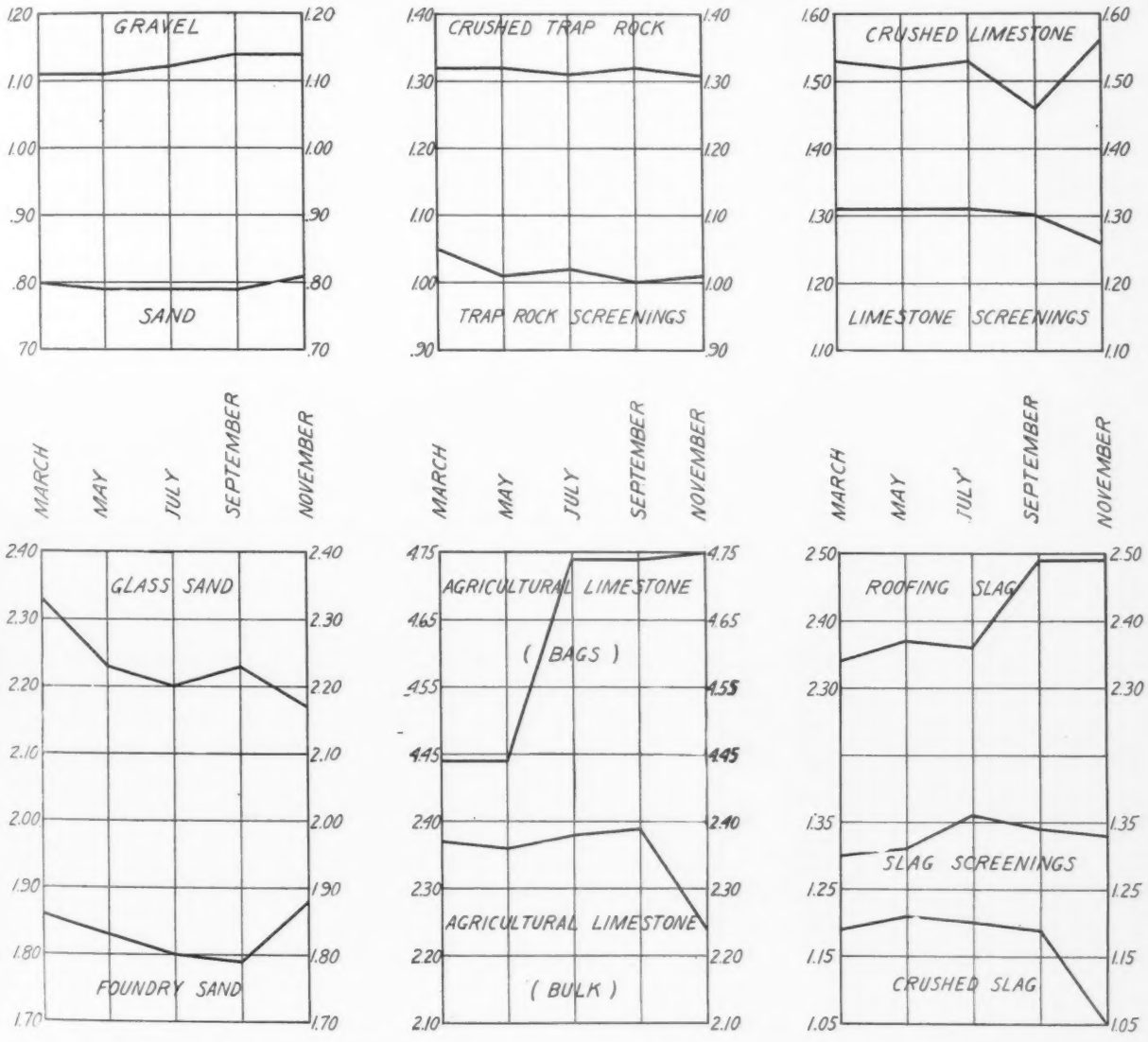
# Price Fluctuations in 1923

IN lieu of the usual four pages of market prices published regularly in ROCK PRODUCTS, we are substituting in this issue a review of sand, gravel, crushed stone, glass sand, foundry sand, agricultural limestone and crushed slag. The prices of the other commodities covered by the term "rock products" were fairly well stabilized during the year 1923. Indeed the prices of the commodities mentioned show more stability than in any previous year—a very helpful sign.

As shown by the first graph, sand and gravel prices throughout the year show remarkable uniformity. The same applies to crushed stone. Undoubtedly the big factor in stabilization was plenty of car supply. There being no acute shortages of cars, there was no time during the year when any consumer was compelled to pay a premium for his material. There was, apparently, little price cutting, owing to a steady demand. Few producers were compelled to find markets for excessive production.

The most interesting feature in any of the graphs is that of agricultural limestone in bags. It is apparent from the graph that as the season advanced there was considerable demand for finely pulverized limestone and that prices advanced correspondingly. On the other hand the price of limestone screenings and of bulk agricultural limestone (coarse material) fell off in spite of the apparent increased demand. This can only mean that the tendency is distinctly toward the use of the finely ground material. This again is a healthful sign to producers of real agricultural limestone. It means a realization on the part of farmers of the greater value of the more highly manufactured form of limestone.

On the whole, producers can find little to complain of in the price of 1923.




*Graphs showing the fluctuations in the prices of sand, gravel, crushed stone, glass sand, foundry sand, agricultural limestone and crushed slag during the year 1923*

# News of All the Industry

## Incorporations

**Earth Products Co.**, Colorado Springs, Colo.; fullers' earth, precious mills, etc., including refinery operations; $100,000. Incorporators: J. W. Ady, Jr., I. Harris and E. S. Edgerly. Representative: Harris & Price, Burns Bldg., Colorado Springs.

**Murray Canyon Rock Co.** of San Diego, Calif., has been incorporated for $100,000.

**Glendale Rock Co.**, Glendale, Calif. Capital stock $500,000.

**Victor Stone Co.**, Bloomington, Ind., changed name to the Victor Oolitic Stone Co. of Victor, Ind., and increased capital from $100,000 to $250,000.

**Universal Crusher Co.**, Grand Rapids, Iowa, increase of capital stock from $50,000 to $200,000.

**Moneta Mineral and Mining Co., Incorporated**, Moneta, Va. Capital stock $5000 to $25,000. R. Q. Young, president, Moneta; W. D. Judy, Jr., secretary, Prestonburg, Ky.; J. C. Bowman, Garth, Ky., and Frank Judy, Prestonburg, Ky. To mine and deal in minerals, gravel, sand, etc.

**Virginia Consolidated Lime Co., Inc.**, Staunton, Va., has been chartered to quarry and deal in limestone, with a maximum capital limited to $150,000 and minimum to $30,000. Incorporators: Najah C. Taylor, president; Robert E. Christian, secretary, and Taylor McCoy, all of Staunton.

**Franklin Sand and Gravel Co.**, Queens, New York; $1000; P. E. and M. A. Buehley, O. M. Youngheim. R. E. Beyer, 305 Broadway, New York City, attorney.

**Summit Placer Gold and Rock Co.**, Johannesburg, Calif.; capital stock $150,000; shares 15,000.

**Dilley Investment Co.**, Los Angeles, Calif.; capital stock, $250,000.

**Ashland Limestone Co.**, Carter, Ky.; capital $200,000.

**Bascom Quarries Co.**, Toledo, Ohio; $50,000; W. G. Scheub, E. V. Anspach.

**Leicester Lime Corp.**, Boston, Mass.; capital $475,000.

**Good Roads Gravel Co.**, Montgomery, Ala., has been incorporated with a capital of $50,000 by W. B. Mobley, T. W. Townsend and others.

**Arkansas Granite Co.**, Little Rock, Ark., has incorporated with a capital of $150,000. W. P. Barr is president and general manager and Walter A. Brannen is secretary and treasurer. Will develop granite quarries on 280 acres.

**Webster Construction and Concrete Co.**, Webster Grove, Mo., has been incorporated by Norman O. Vegley, Bernard C. Edmunds and others.

**Spruce Pine Mica Co.** has been incorporated in Spruce Pine, N. C., with a capital of $1,000,000 by J. A. Mayberry of Spruce Pine and M. G. Yoakum of Charlotte, N. C.

**Missouri Marble Quarries**, St. Louis, Mo., has incorporated with G. J. Breaker, R. T. Maher and others as incorporators.

**Crystal Rock Co.** has been incorporated in Denver, Colo., with 10,000 shares, by J. W. Manguson, Geo. B. Cullings and F. W. McDonough.

## Sand and Gravel

**Star Sand Co.**, Portland, Ore., is erecting a $220,000 structure on the water front in Portland.

**Alabama Sand and Gravel Co.** is now equipped to turn out 125 cars per day from its plant near Montgomery, Ala.

**Cedar Grove, N. J., Sand and Gravel Co.** has been ordered to show cause why the company should not be restrained from proceeding with the erection of a bridge across Peckman river. The complaints allege that the structure will afford only about one-third as much clearance as the county bridges generally.

**Standard Sand and Gravel Co.** has secured a permit to erect a belt conveyor at its plant at the foot of 23rd street, New York, for conveyance of sand and gravel from its river boats to its sand and gravel bins.

**Tennessee-Arkansas Gravel Co.**, recently incorporated in Arkansas City, Ark., has organized with C. C. Hawkins as president and manager, and will produce railroad ballast and commercial sand and gravel.

**Pioneer Sand and Gravel Co.**, Seattle, Wash., has begun erection of an $8000 warehouse at 3476 10th avenue, S. W.

**Glenwood Gravel and Construction Co.** has a 20-carload gravel plant under construction at Glenwood, Ark.

**The Syracuse Sand Co.** of Syracuse, N. Y., has been declared insolvent. Edmund H. Lewis was named referee by the court and Emil Hausen temporary receiver, to take charge of the company's finances and business pending the court proceedings in a settlement of the company's business.

**San-Ore Construction Co.** of McPherson, Kans., who control the largest of the Marquette gravel pits, has donated sufficient gravel to surface the driveways at the tourist camp ground at McPherson, and the surfacing work is now being done.

**Standard Sand and Gravel Co.** of Wheeling, W. Va., will erect a new overhead tramway to handle gravel between the barges on the river and trucks and cars. The cost of the equipment will be approximately $7500 and the work of getting it in shape will be started within the very near future.

**The Troy, Okla., Granite and Gravel Co.** has laid a one-mile spur track to its pit and expects to begin shipping at once.

**It is reported** that a $200,000 sand and gravel plant may be built at North Hudson, Minn., near the Twin Cities. The big contracting firm, Foley Bros., is said to be back of the proposition.

**Wichita, Kans.**, reports the discovery of a new gravel deposit about six miles south of the city which may be developed shortly.

**S. A. Gano** of New Orleans, has purchased sand and gravel rights at Crystal Springs, La.

**L. Harrington & Co.** are preparing plans for a $15,000 reinforced concrete plant for the Salado Gravel Co. of San Antonio, Texas.

**Only two bids** were submitted to the Louisiana Highway Commission for the graveling of Federal Aid Project 101-A of the Natchitoches-Mansfield highway in Louisiana, they being Rapides Gravel Co., Alexandria, $2.50 per cubic yard for 3368 yd. of washed gravel, and Cady-McFarland, Forest Hill, $2.56 for 3368 yd. of washed gravel.

**Machias Sand and Gravel Co.** of Machias, N. Y., has filed bankruptcy schedules in the United States court. The corporation's liabilities are listed at $197,555 and the assets at $101,048. Most of the creditors of the company are located in Buffalo and vicinity. The unsecured claims of the concern amount to $192,797 alone. Henry C. Miller is secretary of the corporation.

## Quarries

**Arkansas Granite Co.**, recently organized with a capital stock of $150,000, has already begun the operation of their quarries located four miles out of Little Rock, Ark., and are daily loading all the granite their capacity will permit. The company owns 280 acres of granite land and will install much new machinery of the most modern type just as soon as it can arrive.

**Indiana Quarry Co.** has purchased 600 acres of fine stone land near Stinesville, Ind., for a sum of $75,000, according to word from Bloomington, Ind. The land was owned by the Illinois Steel Co. and is said to be fine stone land.

**The Boone Marble Quarry** in Nye County, Nevada, is installing equipment to cost nearly $350,000 according to a dispatch from Carson, Nevada.

**Worlock Stone Co.** is to rebuild its plant at Perryville, N. Y., according to announcement made following the settlement of its cases against insurance companies.

## Cement

**The Chelsea, Mich., cement plant**, formerly owned by the Potter estate, has been leased for five years by the state of Michigan. It will be operated by prison labor to produce cement for highway work, according to current newspaper reports.

**Globe Portland Cement Co.**, 416 McKnight building, Minneapolis, Minn., has plans maturing for the construction of a cement mill at Dubuque, Iowa, consisting of a number of buildings, with power house, machine shop and other auxiliary structures, estimated to cost close to $2,000,000, with equipment. H. C. Struchen, 404 Dakota building, St. Paul, Minn., is architect; Charles L. Pillsbury Co., 1200 2nd avenue, South, Minneapolis, is engineer.

**Marquette Cement Co.** will make extensions and improvements in its plant at Cape Girardeau, Mo., to cost about $100,000, including equipment. A new three-story packing and loading works, 80x100 ft., will be constructed. The MacDonald Engineering Co., 53 West Jackson blvd., Chicago, Ill., is engineer.

**Aetna Portland Cement Co.** has plans under way for extensions and improvements in its plant at Essexville, Mich., to include the installation of two new kilns and additional equipment, designed to increase the capacity of the plant from 1200 to 2000 bbl. daily. The work will be carried out early in the spring, and is estimated to cost about $250,000, including equipment.

**Proposals of southwestern railroads** to increase rates on cement from Ada, Okla., to points in Louisiana, were nullified by the Interstate Commerce Commission which suspended until April 13, next, new rate schedule prepared to go into effect December 15. An investigation will be made of the rate situation during the suspension.

**The cities of Dallas, Houston and Fort Worth**, in Texas, offer striking evidence as to the progress of constructing cement buildings. Their principal offices and schools, constructed within the last six or seven years, represent an investment in concrete construction which probably totals between twenty and twenty-five million dollars. These buildings have made such favorable impression because of low cost and utility that cement building is bound to be an important factor in the future development of these cities.

## Lime

**The Mammoth Cement Co.** plans to open its new plant at Cedar City, Utah, in the spring. O. C. Thurber, of Cedar City, heads the organization.

**Ozark White Lime Co.**, F. O. Gulley, Pres., Fayetteville, Ark., has under construction plant improvements, increasing capacity from 50,000 to 100,000 tons.

**American Lime and Stone Co.** plants, which had been shut down for several weeks, have resumed operation. This movement gave employment to a large number of men.

**Gager Lime and Mfg. Co.**, of Chattanooga, is building a new power unit at its plant at Sherwood, Tenn., 55 miles from Chattanooga. This plant is considered one of the best not only in the South but in the country. It has sixteen vertical kilns and two rotary kilns, with a combined capacity of about 300 tons per day.

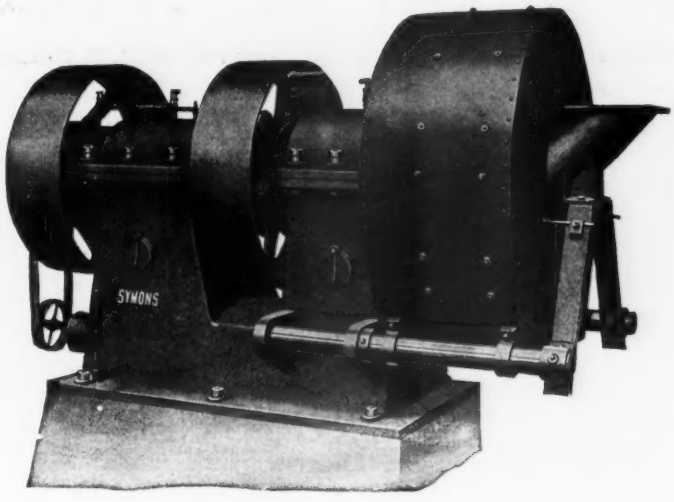
**The Lee Lime Co.** lost its hydrating plant, near Greenfield, Mass., in a fire recently. The damage was placed at $35,000.

## Gypsum

**Gypsum Tile Factory, Inc.**, Huntington Park, Calif., has plans for new works on Slauson ave., estimated to cost $50,000 with equipment. N. J. Martin heads the company.

**United States Gypsum Co.**, Oakfield, N. Y., is building an addition 44 by 600 ft., for the manufacture of gypsum wall board and kindred products, estimated to cost $85,000 with machinery. Headquarters are at 205 West Monroe street, Chicago.

**Imperial Gypsum and Oil Co.**, El Centra, Calif., is now printing its notice of application for patent to the big deposits of gypsum which are already being extensively mined by the company. A train load each day is being shipped from the mines through Dunaway, the station on the San Diego & Arizona Railway.




# 2 1/5c per Ton—Cost of Crushing Stone

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# 36" SYMONS DISC CRUSHER

## Reducing 4" Stone To 1¼"

This company also has a 24" Symons Disc Crusher and they say:

> "We can ship a carload of stone all of a certain size, or if a carload varying in size is wanted, ¾" to 2", it is easily obtained.
>
> "The discs last an average of two years.
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> "The Symons is saving its operating cost every year over what it would cost to do the work with Gyratories."

The Symons Crushers were installed in this plant on the basis of their experience with Symons Disc Crushers in other plants they operated.

The Discs rotate in the same direction at the same speed, eliminating grinding action and excessive wear.

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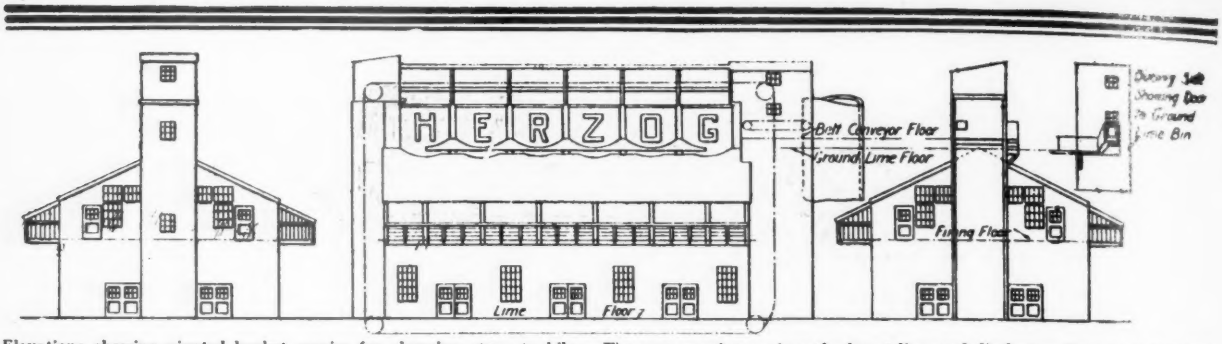
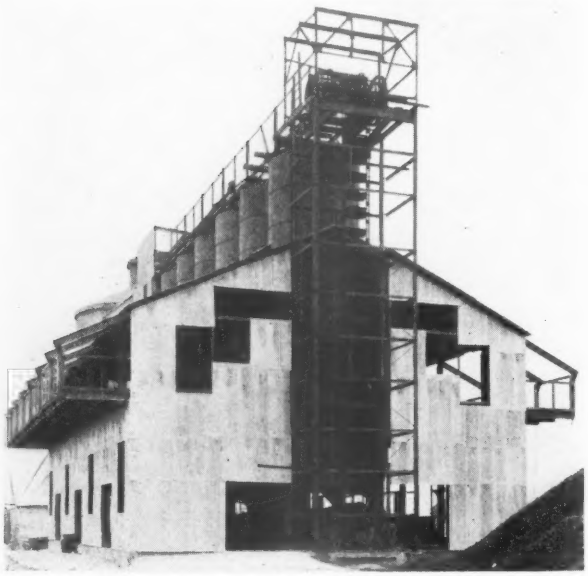



Elevations showing pivoted bucket carrier for charging stone to kilns. The same carrier receives the burnt lime and discharges it to a storage tank



# S-A
# PIVOTED
# BUCKET-CARRIER
## AT
## JOHN HERZOG & SON PLANT

A prominent feature in the design and construction of the lime plant of John Herzog & Son, Forest, Ohio, is the installation of a 24-inch by 24-inch S-A Pivoted Bucket Carrier which is used in place of the usual tramway hoist to elevate stone to the kiln. The S-A Carrier operates thru the center of the plant, making a complete circuit of the kilns carrying horizontally and elevated vertically. The horizontal centers are 86 ft. and the vertical centers are approximately 50 ft. The S-A Pivoted Bucket Carrier used in this installation is of the same design as the popular Pivoted Bucket Carrier which has established such an enviable reputation in handling coal and ashes for power plant service.

Every S-A Pivoted Bucket Carrier is equipped with the patented Complete Turn-Over Dump which causes the buckets to make a complete revolution when in the act of discharging the load, thereby completely clearing the bucket of its contents.

This adaptation of the Pivoted Bucket Carrier to service of this character suggests new possibilities for **time and labor saving** in the lime industry.

**S-A Engineers welcome the opportunities to assist operators in studying the possibilities of installing conveying machinery in the plant.**

Send for Catalog No. 22-R "Pivoted Bucket Carrier"

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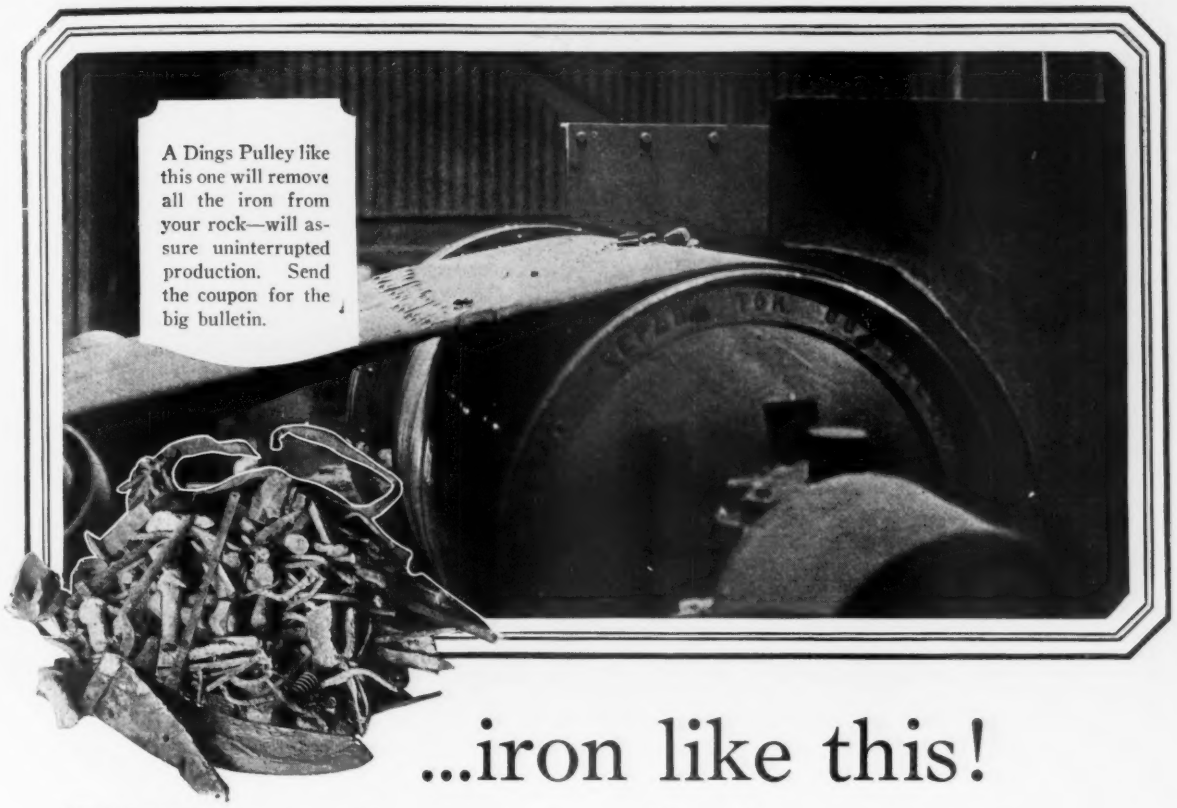
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## *Will it wreck your crusher?*

IRON like this—a pick head, a car spring, a muleshoe, even a bolt or nut—can put your crushers out of business. Are they unprotected—at the mercy of this iron? Or have you adopted the sure-fire safeguard, magnetic separation? Dings "High Intensity" Magnetic Pulleys remove the iron from the rock. They do not allow it to reach the crusher. Crushers are not wrecked. Men are not idle. There are no repair bills. Production is uninterrupted.

Surely you want the bulletin which tells how Dings Pulleys prevent breakdown of crushers and pulverizers. Send the coupon for your copy — free, of course.

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Please send me the free Dings Pulley Bulletin—no obligation.

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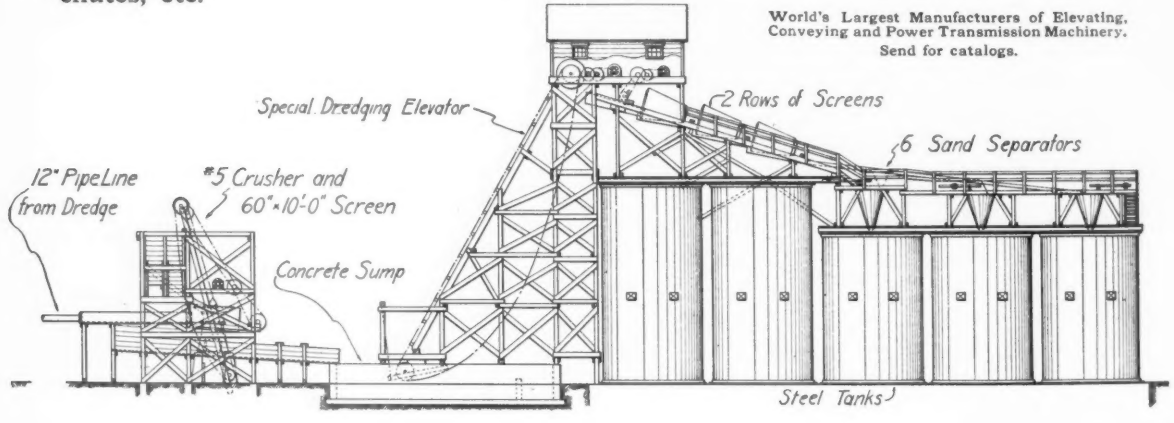


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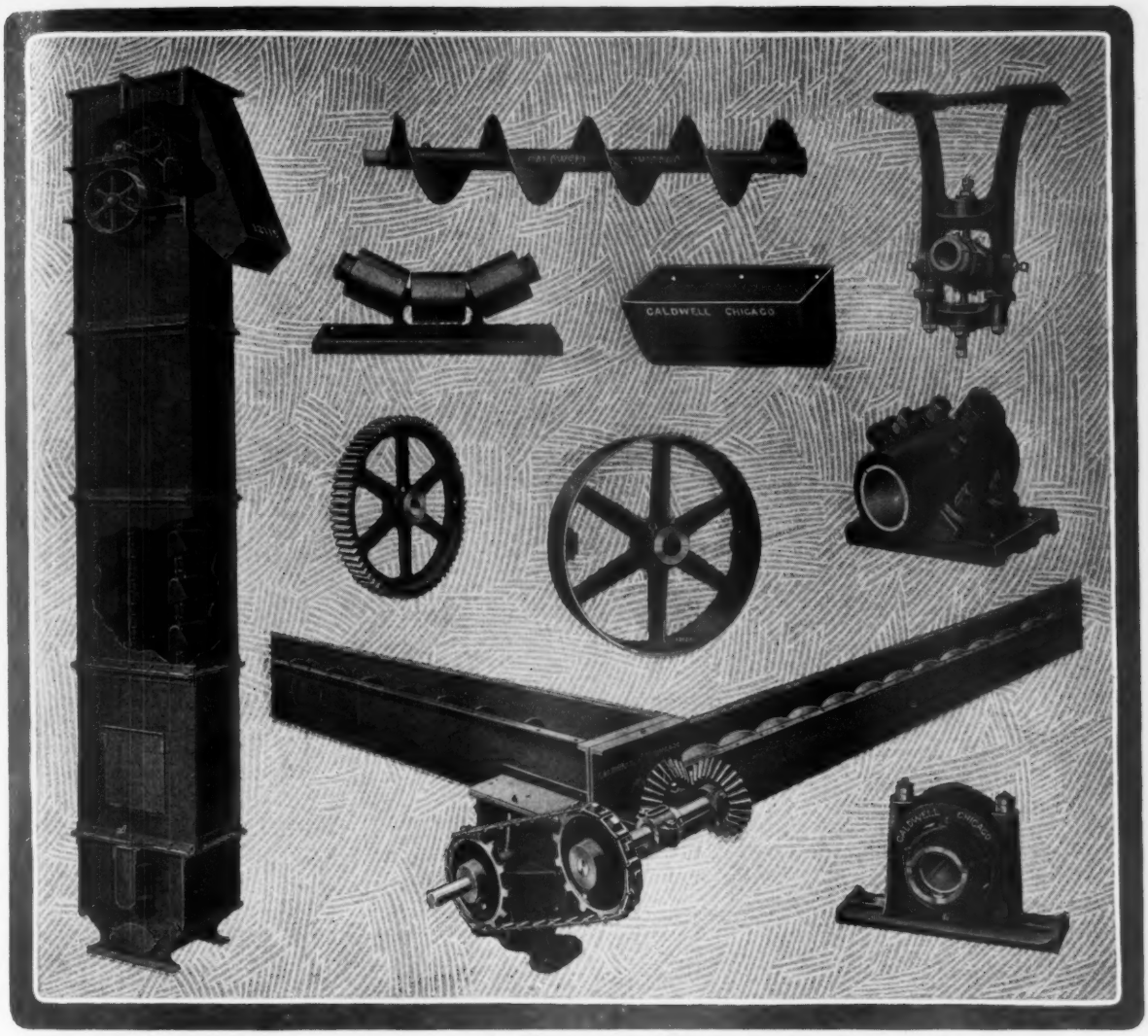


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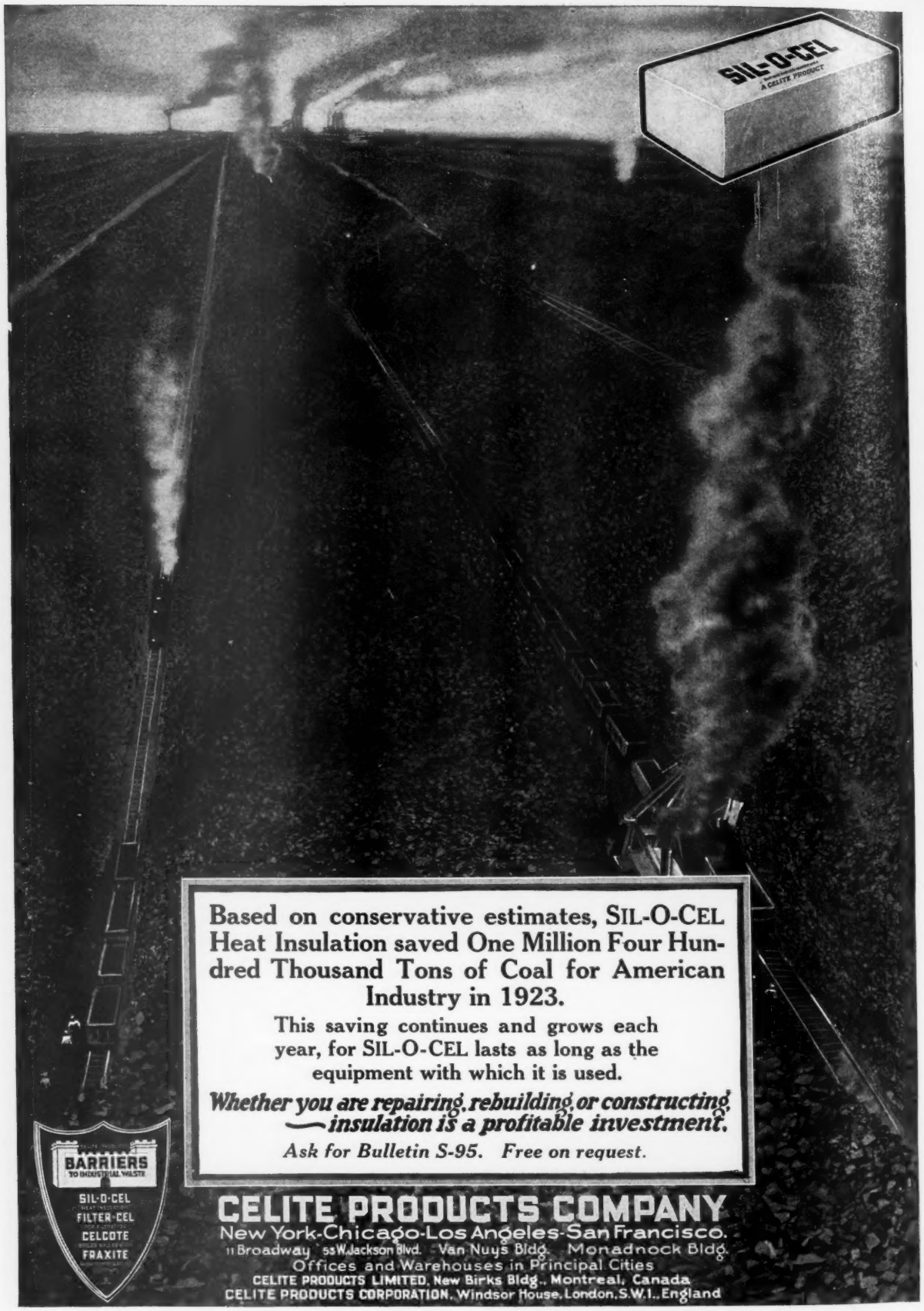
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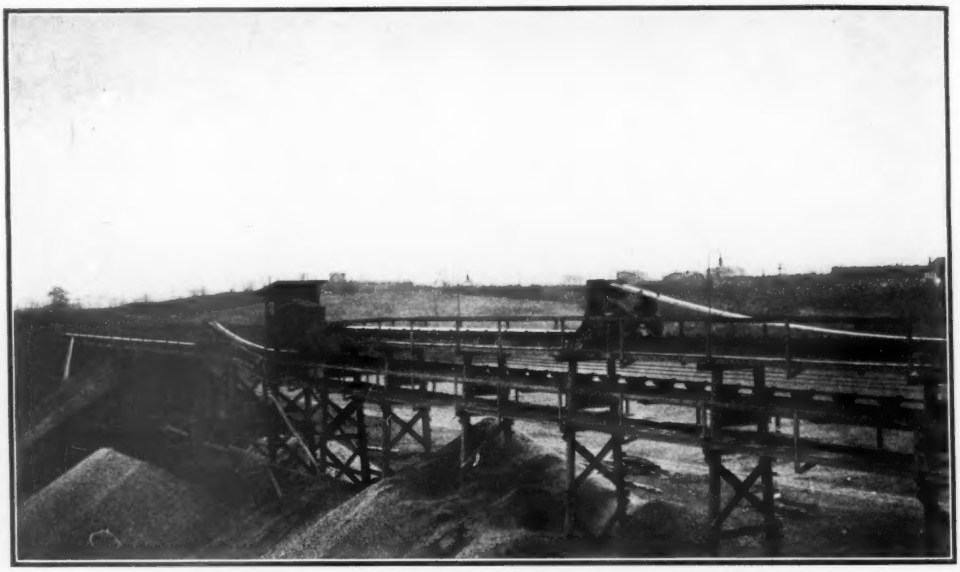

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CATARACT GRIZZLIES that will accurately screen material from ¾" up to 6½". Capacities up to 500 tons per hour.

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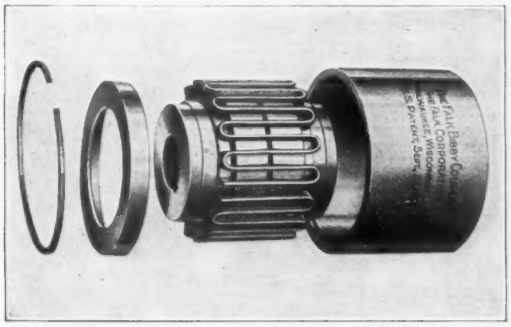

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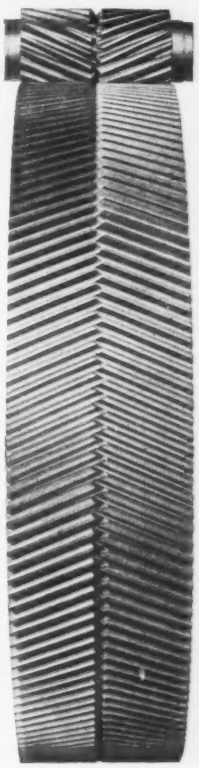

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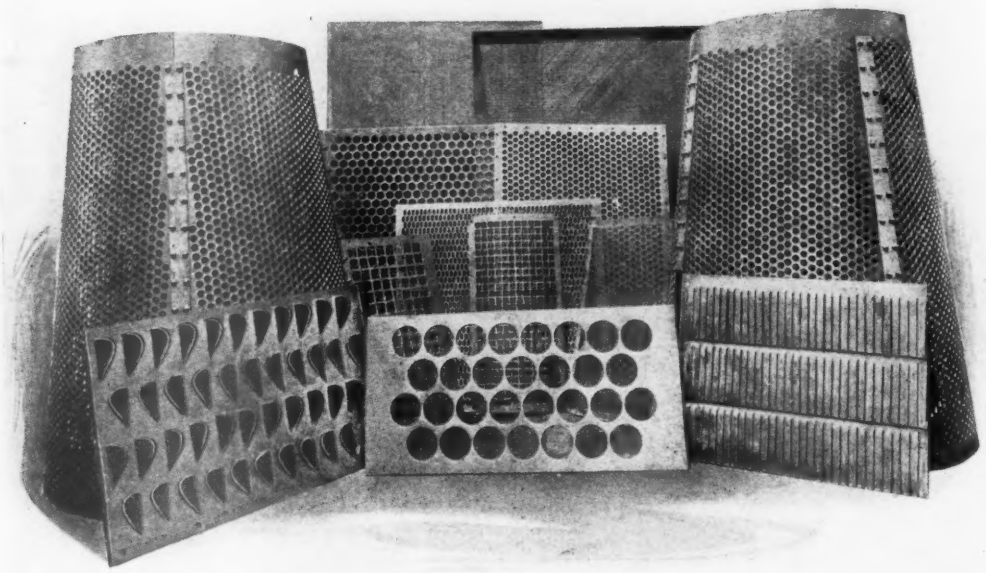

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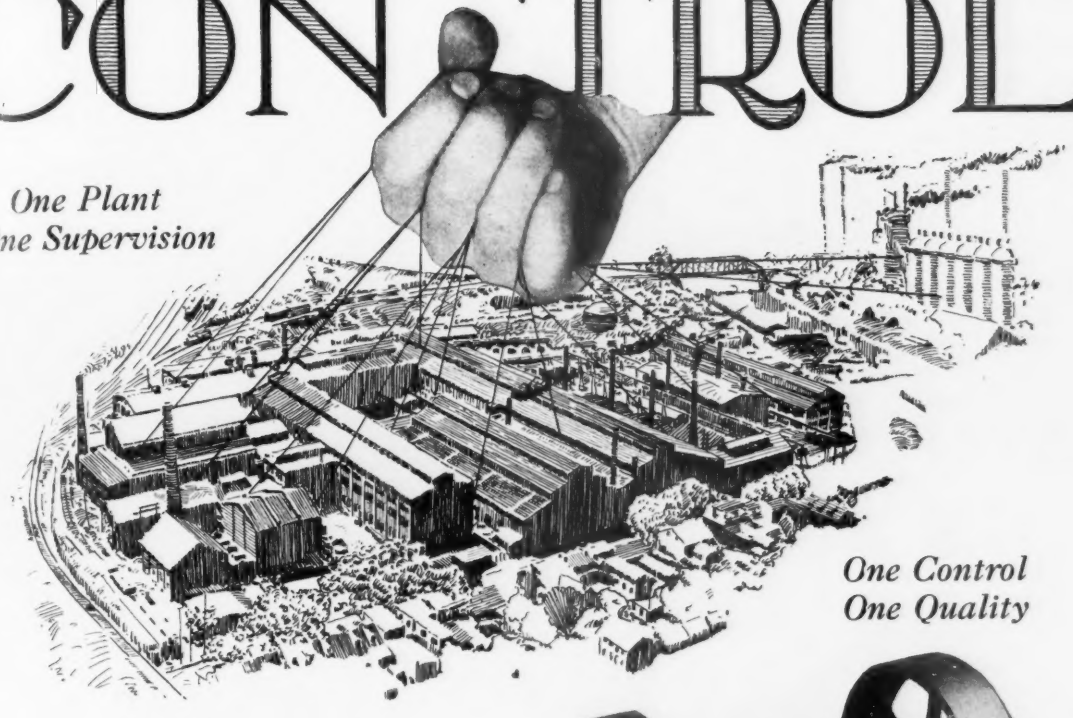

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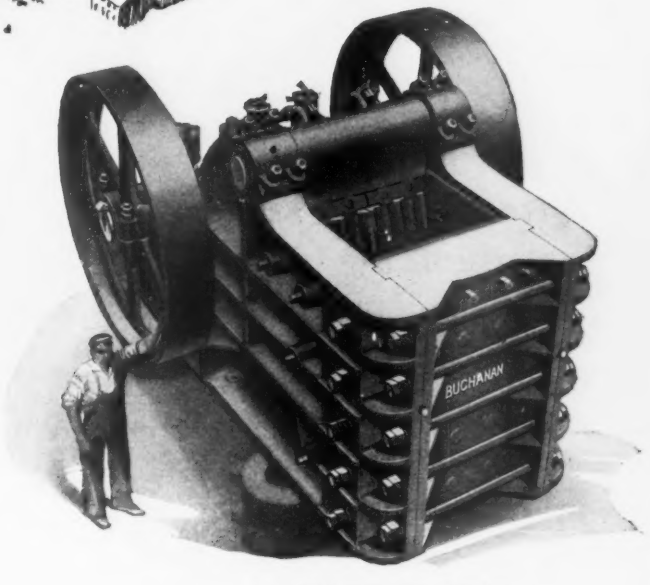
Every part is made in Birdsboro, Pa.

From blast furnace, through steel foundry and machine shop, to the erecting and testing floor, *every operation* is under our own direct control. *We* make certain that your crusher will satisfy you, before it is shipped. Here is one centered responsibility—no alibis—no slighted work. The large capacity of this plant for heavy work is assurance that your order goes through *promptly*. You can depend upon Buchanan Crushers for heavy duty under all circumstances.




**Type "C" Buchanan Jaw Crusher**

## *Send for Bulletins*

Buchanan All-Steel Crushers are made in sizes up to and including 66x84 in. Bulletins fully describes them. *Send for a set.*

**C. G. BUCHANAN CO., Inc.**
**Cedar and West Streets**
**New York City, N. Y.**

*When writing advertisers please mention ROCK PRODUCTS*

# CORDEAU-BICKFORD Detonating Fuse

During the Blast

## Blasting Cement Rock

The engravings shown illustrate the effects during and after a blast at the cement quarry of the Colorado Portland Cement Company, Portland, Colorado.

Result of the Blast

Cordeau-Bickford has been used in this quarry for a number of years, with very successful results.

Cordeau-Bickford is a continuous detonator in contact with the entire depth of the explosive charge. With a detonating speed of 17,500 feet per second, the instantaneous and thorough explosion of a great many charges is assured. Cordeau-Bickford cannot be set off by friction, fire, or any ordinary shock. During the blasting operations, it is not only safe, but the connecting up of a blast is more quickly done, especially if the broken charge method of loading is used.

## The Ensign-Bickford Co.

SIMSBURY, CONN.

**Established 1836** **Original Makers of Safety Fuse**

# ZERO WEATHER BLASTING

KEEP on blasting right through the winter with Grasselli Low Freezing Dynamite. Don't quit during the cold spells. You can shoot enough rock to keep the shovels at it continuously when they start.

What if the temperature does fall to zero or below! Keep right on shooting. Grasselli Low Freezing Dynamite will keep on giving you the same powerful blast—the same clean pull.

The Grasselli Service Department is in operation the year round and our Service men can stand the zero weather too. Call for one at our nearest office if a blasting problem arises. No strings—no obligation—no cost. We are glad to render the service.

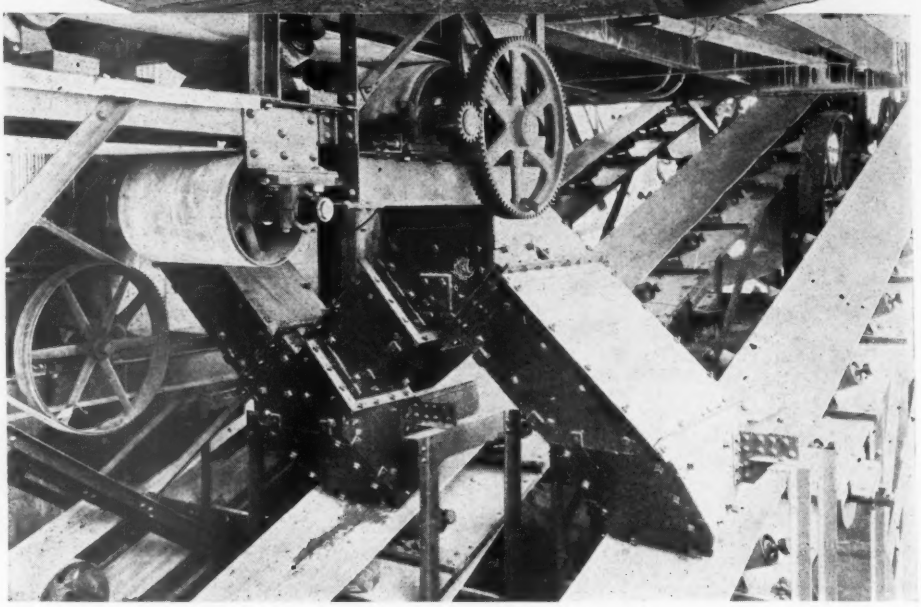
THE GRASSELLI POWDER COMPANY
*MAIN OFFICE: CLEVELAND, OHIO*

*BRANCHES:*
PHILADELPHIA
BLUEFIELD, W. VA.
BIRMINGHAM
WILKES-BARRE, PA.
BROWNSVILLE, PA.

CHEMICALS SPELTER GRASSELLI COLORS EXPLOSIVES ESTABLISHED 1839

PITTSBURGH
CHICAGO
POTTSVILLE, PA.
CLARKSBURG, W. VA.
HAZLETON, PA.
NEW CASTLE, PA.

# GRASSELLI EXPLOSIVES



# Dodge Conveyors exclusively in the new United Verde Smelter

The smelter at Clarksdale, originally designed as a 3,000 ton plant, has been brought up to 5,000 tons' capacity.

Dodge conveying equipment, as well as power transmission appliances, are used throughout the new plant.

Sturdy design and standardized methods of manufacture point to Dodge equipment as the logical choice of discriminating buyers who place continuous service and low upkeep expense as of first importance.

Write for further details and complete catalog of elevating and conveying equipment, as well as power transmitting machinery.

DODGE MANUFACTURING CORPORATION

*General Offices:* Mishawaka, Ind. *Works:* Mishawaka, Ind., and Oneida, N. Y.

EVERYTHING FOR THE MECHANICAL TRANSMISSION OF Power

*Branches:* New York Philadelphia Pittsburgh Boston Cincinnati Newark Chicago Atlanta Minneapolis St. Louis Houston Seattle San Francisco

# *Have you a stiff neck in your business?*

A STIFF neck on the other fellow sometimes looks funny, but it never feels funny to the fellow it hurts.

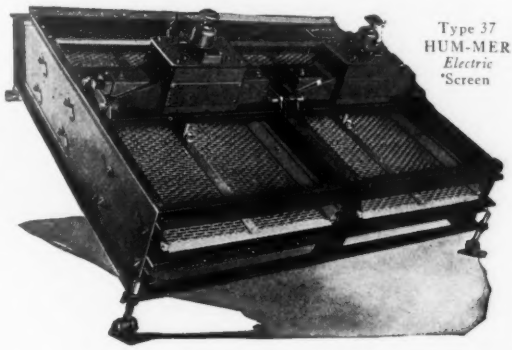
Besides, you see, a neck isn't a genuinely useful neck if it isn't flexible.

And yet, many industrial plants have a stiff neck somewhere in the process of production—and my how it hurts the profits!

Usually this industrial stiff neck is some machine that is awkward and slow, or it is a bit of equipment that can't stand the gaff and is a constant repair annoyance to the men and expense to the company. Or it is an operation that just isn't up to the standard of the rest of the plant.

Often the stiff neck will be found at the point where you separate your materials. Maybe the stiffness isn't especially noticeable. But when you see for yourself how flexible that neck can be made by using the HUM-MER, and how much less delay and repair trouble you have, and how much more profit you can make by letting the HUM-MER do your separating, then you'll agree that the old stiff neck was a nuisance and a wasteful expense.

Whether you want (1) a faster output (more volume), (2) a cleaner-cut separation (better quality), (3) less delay and repair expense, or (4) more profit—or all four of these—look up the HUM-MER, because it sets new high records all four ways.



Type 37 HUM-MER *Electric* Screen

***Request Catalogue 45-R***

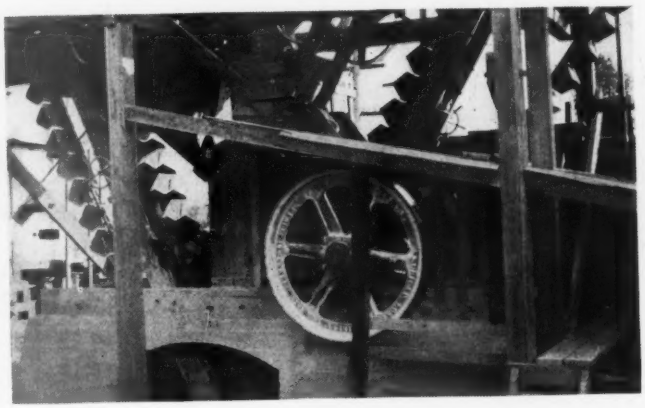
THE W. S. TYLER COMPANY

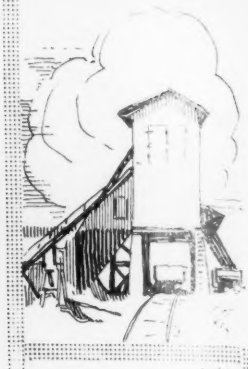
***Cleveland, Ohio***

***Manufacturers of*** **Woven Wire Screens and Screening Equipment**

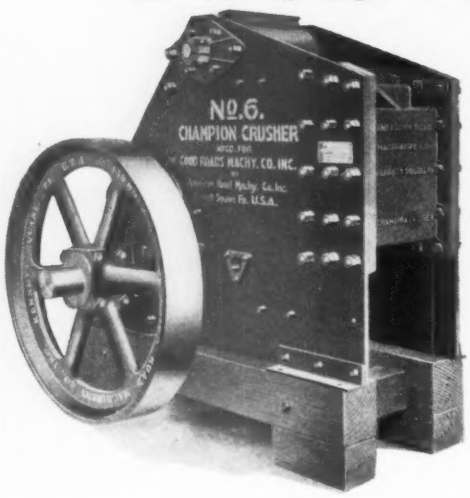
# HUM-MER *Electric* SCREEN

**Screens from the coarsest to the finest material, either wet or dry**





# CHAMPION CRUSHERS




It is fitting that a Champion Crusher should be on the job at the Champion Sand and Gravel Company's plant at Pound, Wis., and, in keeping with its name, the Champion outfit is performing in record breaking style.

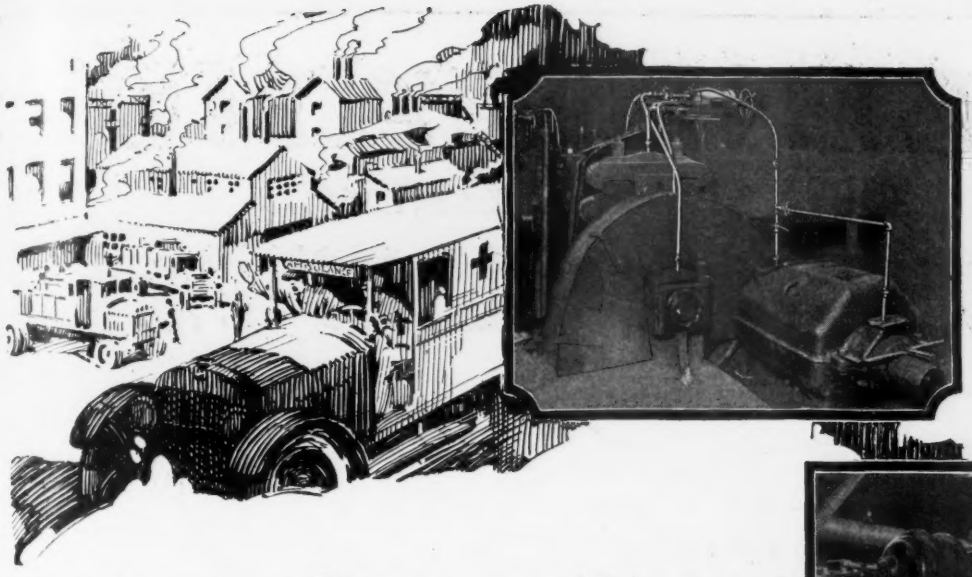
When you consider our years of experience in designing and building Crushing, Elevating, Screening and Conveying Machinery, it is only reasonable to expect when you invest in the Champion that you will get convenient, durable, serviceable and superior machinery that will meet every ordinary or extraordinary requirement.

We design, build and install complete crushing plants, or complete outfits for crushing, screening and washing sand and gravel. We specialize in the building of elevators, screens and conveyors of any size desired.

Ask for Sand Gravel Machinery Catalogue, or Champion Crushing and Quarrying Catalogue.

**The Good Roads Machinery Co., Inc.**
**Kennett Square, Pa.**

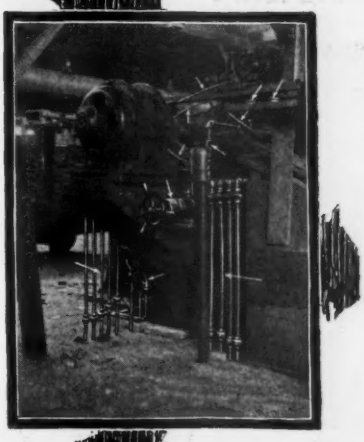
**905 Tower Building, Chicago, Ill. 1523 Oliver Building, Pittsburgh, Pa. 50 Church Street, New York, N. Y.**
**61 Oliver Street, Boston, Mass. 567 Whitehall Street, Atlanta, Ga.**
**931 Santa Fe Ave., Los Angeles, Cal.**



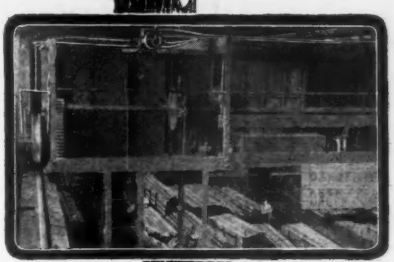
*Here are a few of the hundreds of Keystone Manifold Safety Lubricator installations.*

*(a) On cold scrafing machine, as well as Westinghouse motor bearings. (b) Crane installations. (c) Cabinet planer. (d) Industrial locomotive.*

A



B



C

# *Insurance will not save this man*

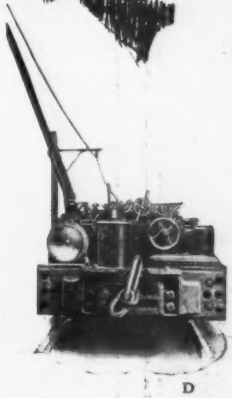
AN insurance policy, while it provides compensation, does not provide safety:—it cannot protect the "oiler" or prevent accidents. You can doubly insure your "oiler" by building the best insurance — safety insurance—right into your machinery.

The hazards—the risks—attending the efficient lubrication of hard-to-reach, inaccessible bearings has been minimized — overcome. With the Keystone Manifold Safety Lubricator, the operator stands at one safe, convenient place and, turning a wheel, lubricates the bearings positively — efficiently — economically.

This is but one of many features that has won instant acceptance for this Keystone high pressure grease lubricating system with engineering authorities everywhere. It minimizes lubrication neglect; keeps dirt, grit, and their abrasive action, out of the bearings; overcomes waste of lubricants; as well as interrupted production while lubricating.

Our free booklet gives details — write!

THE KEYSTONE LUBRICATING CO., PHILADELPHIA
at 21st & Clearfield Streets *Branches Everywhere*



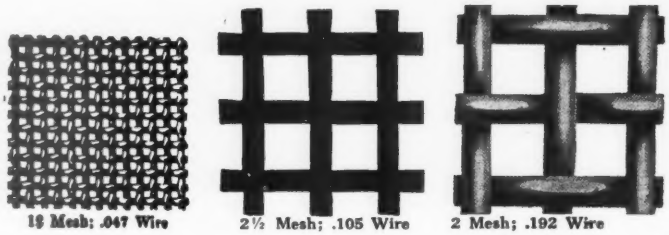
D

## *Keystone Manifold Safety Lubricator*

MULTIPLE FEED, HIGH PRESSURE GREASE LUBRICATING SYSTEM

# "CLEVELAND"
## DOUBLE CRIMPED
# WIRE CLOTH

*Uniformity Assured—*



1¢ Mesh; .047 Wire 2½ Mesh; .105 Wire 2 Mesh; .192 Wire

When you buy wire cloth, of course you want the cloth that gives maximum wear. You want, in addition, uniform fineness and immediate service at a right price.

Buy Cleveland Double Crimped Wire Cloth and you are sure of these things.

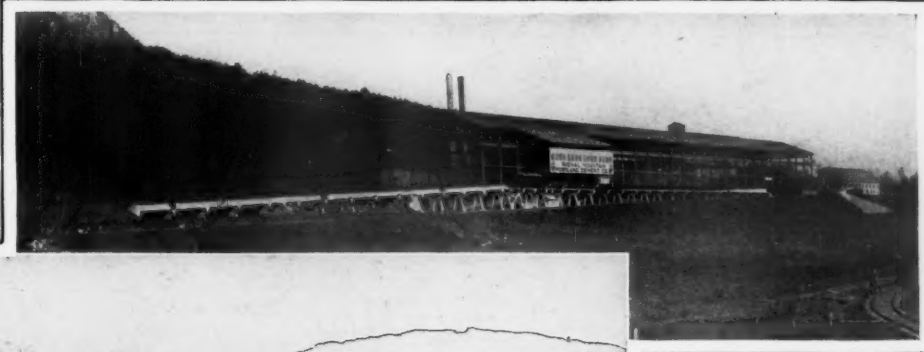
The materials in this cloth are the finest and most serviceable to be found. It is the cloth for long, reliable, economical screening of sand, gravel, crushed stone, lime or other materials, and no other cloth on the market assures the same uniform fineness.

We always carry a large stock on hand. Any special mesh will be manufactured to suit requirements.

---

**THE CLEVELAND WIRE CLOTH AND MANUFACTURING COMPANY**

**3573 East 78th Street** **Cleveland, Ohio**



Western

*That's Why*

# WESTERN Dump Cars—

The new wet-process plant at Chattanooga, Tenn., operated by the Signal Mountain Portland Cement Co., uses 16-yard Western Air Dump Cars to convey rock from the quarry to the crushing plant.

An 85 ton shovel is used at this plant, and the impact of the immense tonnage of rock dumped onto the cars is terrific. The plant designers agreed there was nothing on the market that could stand the abuse as well as the "Western."

"Western" Dump Cars will stand abuse. They will OUTWORK and OUTWEAR other dump cars.

**Western Wheeled Scraper Company**
**Earth and Stone Handling Machinery**
**1400 Farnsworth Avenue**
**AURORA, ILLINOIS**

# There's Extra Wear Built Into Every Indestructible Conveyor Belt

NEW YORK BELTING & PACKING CO. Founded 1846 Incorporated 1856

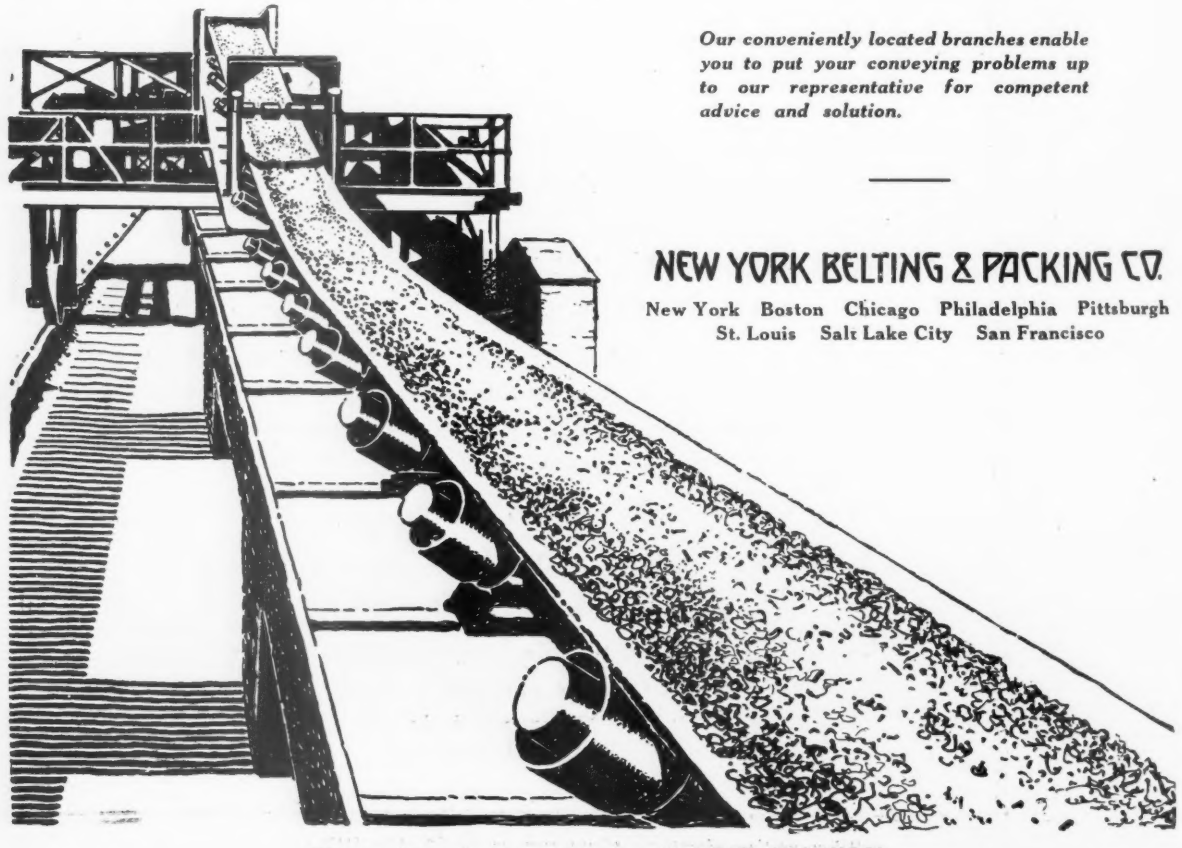
**Rubber Goods for the Rock Products Industry**

Indestructible Conveyor Belting
Inspiration Elevator Belting
Test Special Transmission Belting
Indestructible Air Drill Hose
Indestructible Water Hose
Indestructible Steam Hose
Firo Superheat Sheet Packing
Indestructible Sheet Packing
Cobbs Piston Packing
Pump Valves

It's the plus wear that counts—the wear beyond the ordinary length of useful life you expect of a conveyor belt. Extra tonnage carried over and above what may be reasonably efficient service, is the true test.

The thorough knowledge of quarrying conditions that enters into the planning of every Indestructible belt results in a type of wear-defying construction that comes through the test of heavy conveying work with cost figures well on the credit side.

The correct weight and kind of duck in the right number of plies, bonded with a tenacious rubber friction and amply protected by a properly resistant rubber cover—these go to make up a conveyor belt possessing inherent quality.



*Our conveniently located branches enable you to put your conveying problems up to our representative for competent advice and solution.*

NEW YORK BELTING & PACKING CO.

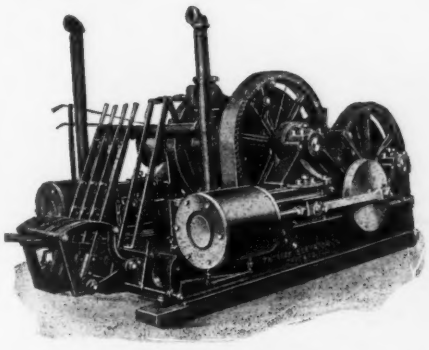
New York Boston Chicago Philadelphia Pittsburgh
St. Louis Salt Lake City San Francisco

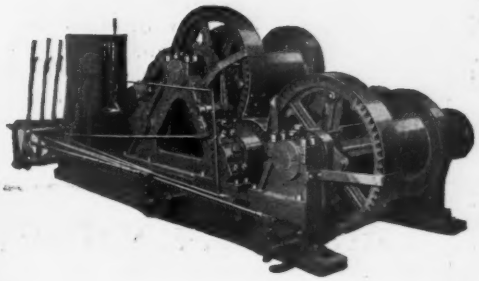
# Thomas Hoists

Thomas Hoists are designed and built for maximum tonnage and to give dependable service for every requirement of the sand, gravel and stone producer. They are made in single and two speed types — either steam or electric — for Dragline Cableways — Drag Scrapers — — Derricks — Bucket Operation, or Car Haulage.

***When you want a strong, sturdy, dependable hoist, together with maximum tonnage, we would appreciate an opportunity to discuss your problem with you***

**Thomas Elevator Co.**
**27 South Hoyne Avenue Chicago, Ill.**





# SANDUSKY LIME BARRELS

A telescoped barrel ready to draw in top and drive hoops. We furnish device for doing this work

## *Perfectly Made*

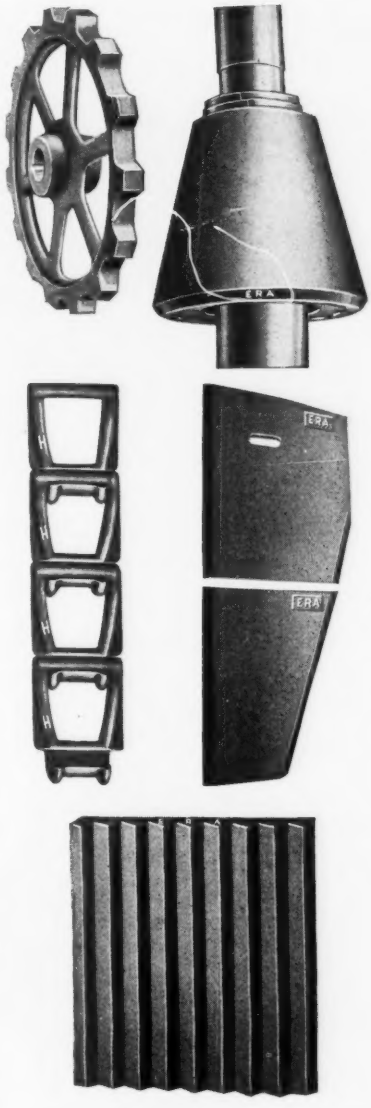
This organization maintains 52 shops and warehouses in the Eastern and Central States. One of these operations is close enough to give you instant service on kiln dried steel hoop barrels. Shipments can be made in "made up" or "Sandiscoped" form.

No expense has been spared in the development of a proper lime barrel made with kiln dried staves, steel hoops, as well as wire and wood hoops. Tongued and grooved staves are used in our sift-proof, practically moisture-proof, non-slacking lime barrel, which will carry your lime to destination and maintain its condition in storage.

Eight stave and heading mills guarantee perfect service to customers.

**SANDUSKY COOPERAGE & LUMBER CO.**
**General Office, St. Louis, Mo.**

MANGANESE
THE FIRST ERA STILL LEADS IN QUALITY
STEEL
THE HADFIELD-PENFIELD STEEL COMPANY
BUCYRUS, OHIO



# Building a Good Name

We who make and sell "ERA" Manganese Steel have one thought in mind—the building of a reputation for **our product.**

We never expect to complete this work, for there is no limit to reputations—they are built on that everyday virtue—DEPENDABILITY. Day after day—year after year—serving our customers with quality Manganese Steel—a real **"stand up"** and "wear" metal that we can be proud of. A trial order will make you one of our regular customers.

**May we quote on your requirements?**

## The Hadfield-Penfield Steel Co.

**Bucyrus, Ohio, U. S. A.**

# A Revolutionary Development in Pulverizing

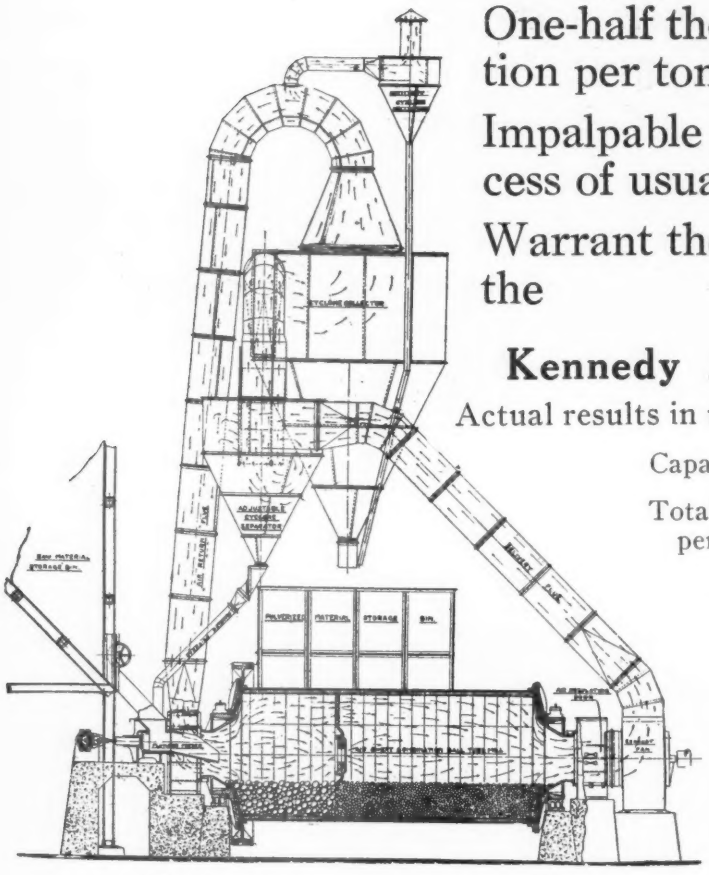
Twice the usual capacity for mills of same size;

One-half the usual power consumption per ton of finished material;

Impalpable powder greatly in excess of usual percentage;

Warrant the above statement about the

## Kennedy Air-Swept Tube Mill



Actual results in use on grinding limestone* show:

Capacity of 11.8 tons per hour.

Total power consumed less than 11 H.P. per ton.

Product in First Cyclone
- 84.5% minus 200 mesh
- 94.8% minus 150 mesh
- 99.2% minus 100 mesh

All product from Second Cyclone passing 350 mesh seive.

Dryers ordinarily unnecessary. High percentage of moisture dissipated by air passing through mill.

Grinding is accomplished by a slowly revolving mass of balls against steel renewable liners.

This insures maximum continuous operation. Finished product is air swept from mill immediately upon reaching required fineness. Fineness of product is controlled by regulating velocity of air through mill.

**Send for Catalog G-7**

**Kennedy-Van Saun Mfg. & Eng. Corp.**

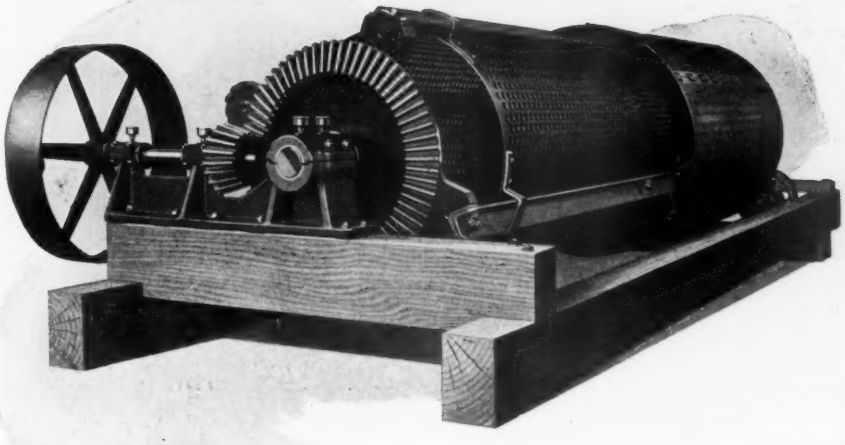
**Factory, Danville, Pa.**

**50 Church Street, New York City**

**French Office: Compagnie des Entreprises Industrielles, 40 Rue Des Mathurins, Paris, France**

*Name and location of plant on request.

# TOEPFER



## Quality Products

Toepfer Products are like good, old reliable friends. They are always ready when called upon—no fussing, no cooking—and year after year you can count on a reliability of performance with confidence.

We feel that is the real element of value, which make our products more desirable and add so much to the satisfaction of having equipment which performs uninterruptedly.

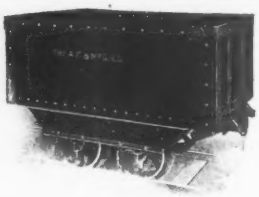
Our products include Elevators, Sand Washers, Washing Screens, Grizzlies, Feeders, Conveyors, Bin Gates, Perforated Metals.

**Our Catalog Is Yours for the Asking**

**W. Toepfer & Sons Co., Milwaukee, Wisconsin**

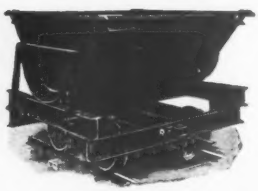
# ATLAS CARS

No. 161
Steel Gable Bottom Car

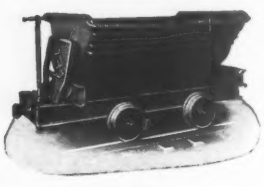


No. 271
End Dump Car, with automatic trips on door

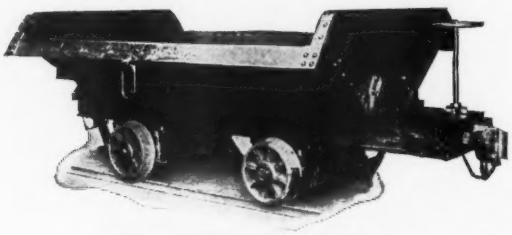
No. 272
End Dump Incline Car



No. 173
End Rocker Dump Car, with brake, large capacity



No. 217-H
Side Dump Car, heavy construction for steam shovel use



**Heavy Duty Quarry Car**

The right decision concerning the design of the dump car that will exactly meet unusual conditions existing at your plant, requires good sense, good judgment at every step of the way, and a thorough knowledge of the business that can be gained only through wide experience.

We have been in the business of building dump cars for a long time. We have built them for many people, built them according to our customers' ideas and our ideas.

Through this wide experience we have acquired a definite knowledge of reinforcement requirements until now, when we build, we **know** just where the reinforcing should go, and just how it should be done.

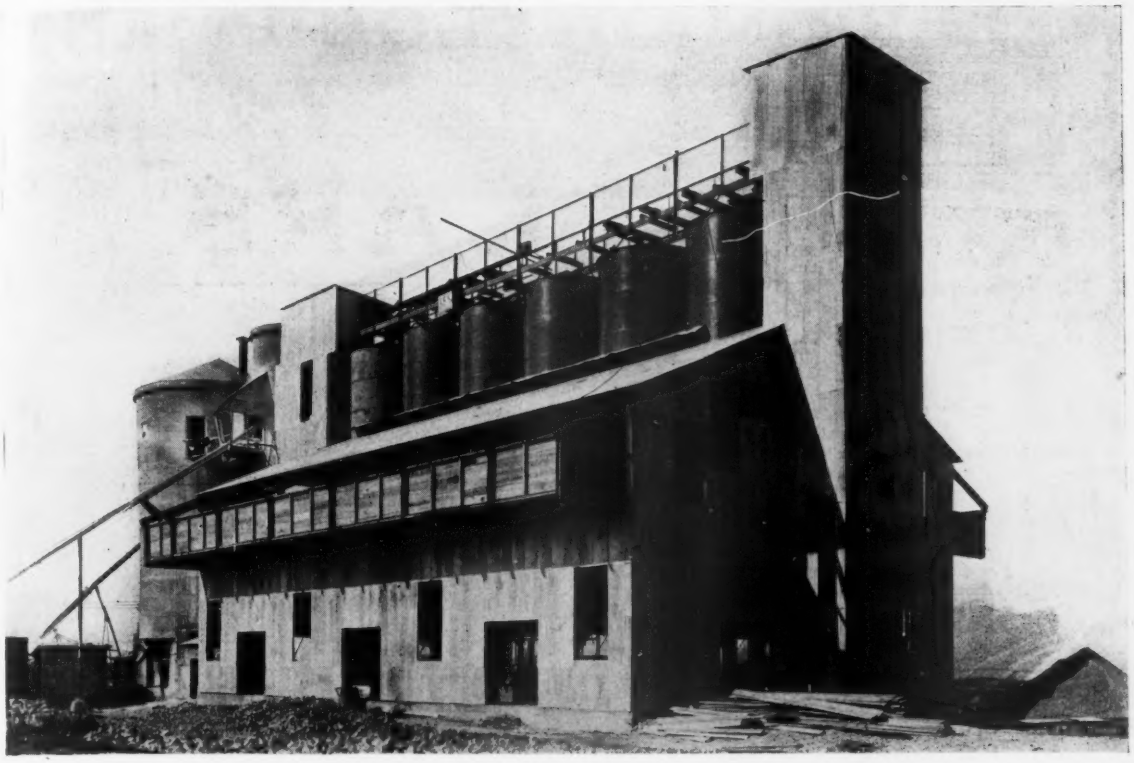
Not much wonder, then, that Atlas dump cars stand the "gaff" better than the average.

***"A Car for Every Purpose"***

## THE ATLAS CAR and MANUFACTURING CO.

**Manufacturers** **Engineers**

**Cleveland, Ohio, U. S. A.**



# John Herzog & Sons New Plant, Covered with

# ARMCO INGOT IRON

TRADE MARK

ARMCO-Ingot Iron has demonstrated its long-lasting qualities in the rock products industry.

The building surrounding the kilns of the new plant operated by John Herzog and Sons, Forest, Ohio, is covered with corrugated galvanized ARMCO-Ingot Iron. The roof is 22 gage, the siding 24 gage. The building is 64 feet wide by 102 feet long over all.

ARMCO-Ingot Iron is the world's purest commercial iron. It has the rust-resisting properties of old fashioned iron. Its chemical purity and uniformity assure every user full value for the money invested.

You can always identify ARMCO-Ingot Iron by the blue Armco Triangle which is stamped on every sheet. It is the symbol of purity, density, uniformity and economy.

TRADE MARK ARMCO REG. U.S. PAT. OFF.

Ingot Iron

## The American Rolling Mill Co.

**Middletown, Ohio**

# WELLER-MADE EQUIPMENT

**For Handling the Materials Mechanically**

**Increase the Output and Reduce Costs by Employing Weller-Made Machinery to Do the Work**

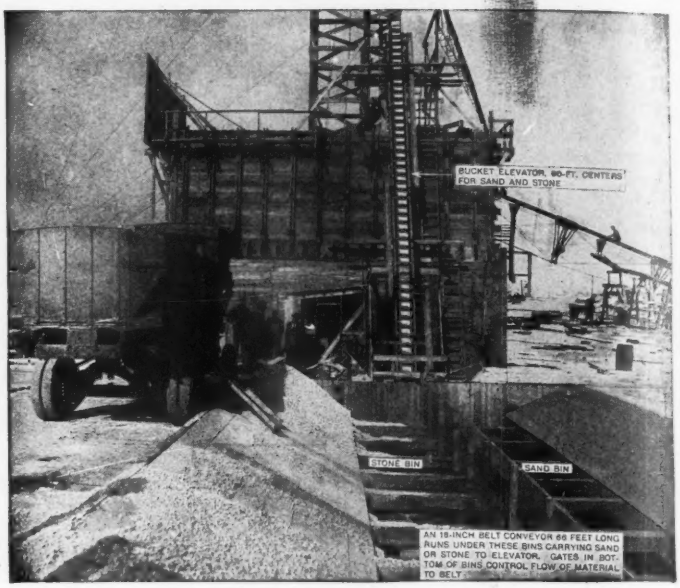
It is sturdy and reliable. Never lays down on the job. The cost of operation is small. Will help pay dividends.

**We Make**
**Conveyors of All Types**

| | |
|---|---|
| **Bucket Elevators** | **Portable Elevators** |
| **Steel Storage Bins** | **Bin Gates** |
| **Screens** | **Sheet Metalwork, etc.** |

WELLER MADE CHICAGO

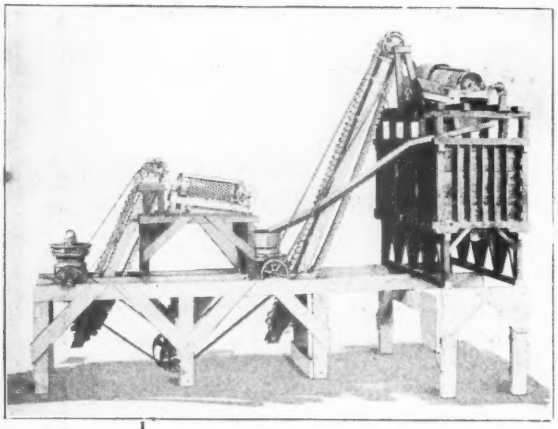
Write and let us know the kind of equipment you are interested in or the material you want to handle. Catalogues showing installations, also data to help in selection of equipment, will be sent.


BUCKET ELEVATOR, 90-FT. CENTERS FOR SAND AND STONE
STONE BIN
SAND BIN
AN 18-INCH BELT CONVEYOR 66 FEET LONG RUNS UNDER THESE BINS CARRYING SAND OR STONE TO ELEVATOR. GATES IN BOTTOM OF BINS CONTROL FLOW OF MATERIAL TO BELT

## WELLER MFG. CO.

**1820-1856 North Kostner Avenue** SALES OFFICES **Chicago, Illinois**

**New York Boston Baltimore Pittsburgh Cleveland San Francisco Salt Lake City**



# AT THE ROAD SHOW, SEE THE FAMOUS TELSMITH MODEL CRUSHING PLANT—

It is not a mere model, but a small operating plant, with genuine Telsmith Crushers. These little machines are equipped with steel frame and crown, bolt-shaft of high-carbon steel, renewable babbitt sleeves and automatic lubrication—just like full size Telsmith Crushers. The midgets will take a chokefeed of hard granite, crushing to ⅛" size, working with the same cool precision that is characteristic of Telsmith equipment. Better look over the famous Telsmith Model Crushing Plant at the Road Show in Chicago. You will be welcome at our booth. If you can't come, will be glad to send you Catalog No. 166 (Telsmith Primary Breaker) and Bulletin No. 2-F-11 (Telsmith Reduction Crusher).

## SMITH ENGINEERING WORKS

**3188 Locust Street** **Milwaukee, Wisconsin**

**Canadian Representatives: Canadian Ingersoll-Rand Co., Montreal, P. Q.**

# Austin Motor Rollers

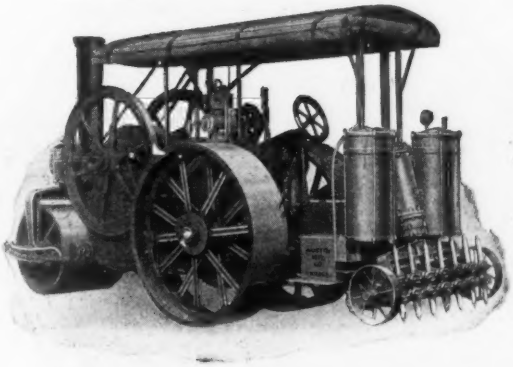
## *"They Serve You Right"*

Everything you expect of a road roller you will find in the Austin Motor Roller to a greater degree than in any other.

Economical to operate and maintain, able to turn out more work in a given time than any other, and absolutely reliable—your first experience with one of these machines will be a revelation of REAL ROLLER SERVICE.

Three-wheeled rollers in two styles (single or twin engines) and five sizes (7, 8, 10, 12 and 15 ton)—there is a style and size exactly suited to your individual requirements. Pneumatic scarifier can be attached to the 10-ton and larger sizes, as shown in the photographs.

**Special Catalog FT tells the whole story of Austin Motor Rollers. Write for your copy today.**



**THE AUSTIN-WESTERN ROAD MACHINERY CO.**

**CHICAGO**

**Branches in 22 Cities**

***"Everything from a Drag Scraper to a Road Roller"***

# AUSTIN GYRATORY CRUSHERS

**Stationary and Portable Types**

Austin equipment in your crushing plant will solve your most difficult production problems. Austin Crushers have features found in no others, while Austin Elevators, Screens, Cars and other accessories are in a class with the crushers.

Maximum output with minimum delay is the combination responsible for the remarkable operating records made by Austin equipped plants.

Crusher Catalog 29-T tells the whole story. Drop us a card and we'll send you one by return mail.

**AUSTIN MANUFACTURING CO.**

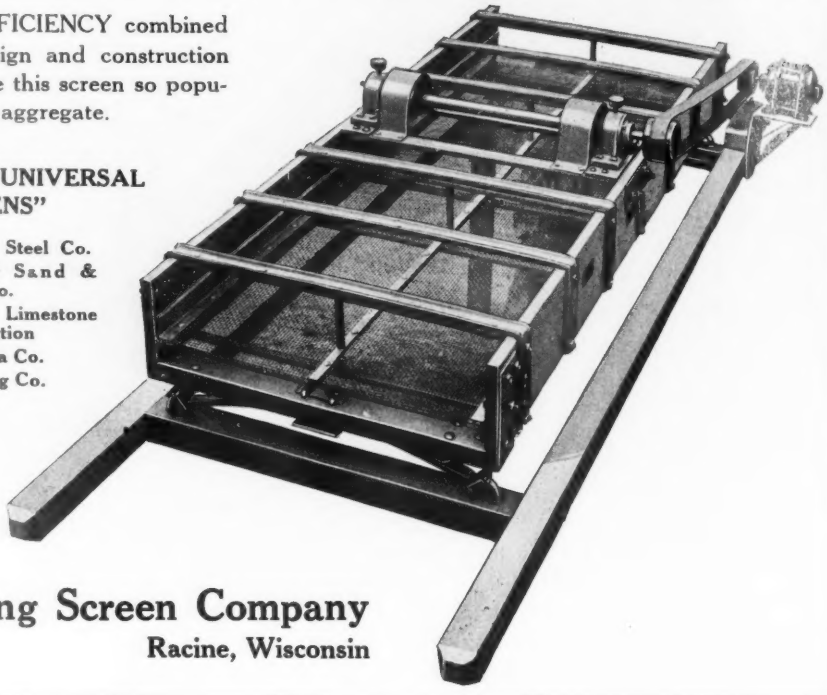
**New York Chicago San Francisco**

# UNIVERSAL Vibrating Screens

HIGHEST SCREENING EFFICIENCY combined with SIMPLICITY in design and construction are the factors that have made this screen so popular with producers of mineral aggregate.

**A Few Prominent Users of "UNIVERSAL VIBRATING SCREENS"**

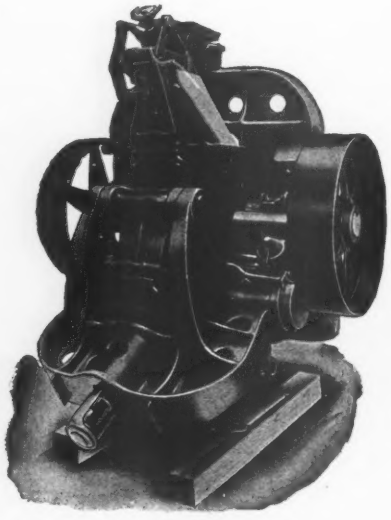
Consumers Co.
Standard Slag Co.
Wyoming Coal Co.
New Jersey Zinc Corporation
Peterson Sand & Gravel Co.
Bethlehem Steel Co.
Armstrong Sand & Gravel Co.
Virginian Limestone Corporation
Acme Silica Co.
Buffalo Slag Co.



*Screens furnished with or without motors.*

*May we send you a booklet describing these screens?*

**Universal Vibrating Screen Company**
1530 Packard Avenue Racine, Wisconsin



# MAXECON MILL

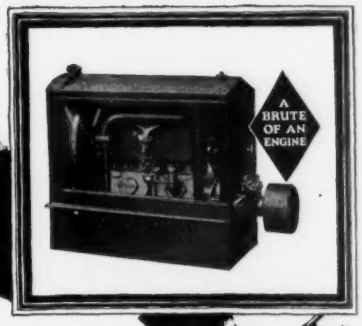
**For Fine Pulverizing of**
**Limestone, Gypsum, Phosphate, etc.**
EFFICIENT—ECONOMICAL—RELIABLE

## PERFECTECON SCREEN SEPARATOR

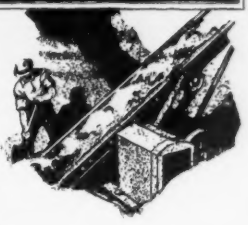
**For Large Capacity Screening**

*Let These Solve Your Cost and Trouble Problems*

**KENT MILL COMPANY**
10 Rapelye Street Brooklyn, N. Y.




Jammed in a corner! Still it works every minute



BEAVER Power Unit takes up little space. It operates just as efficiently tucked away in a corner as out in the open. An all steel housing protects it from falling gravel, while its sturdy construction enables it to perform at top speed day after day. Sand pit and quarry owners like it because it seldom takes "time out" for itself. And it remains active on the job long after ordinary power units have grown ***feeble through usage.*** Beaver Power Unit contains a deep breathing valve-in-the-head engine built for the severest work and leadership. It can drive hoists, conveyors, pumps or a complete plant—and do it with the ***strength of a brute.*** Let it set the pace for your job.

***There is a size Beaver Power Unit particularly adaptable to your requirements. It will burn gasoline, kerosene or distillate. Get detailed information from a Beaver distributor or write direct.***

**Beaver Manufacturing Co.**
**40 25th Street Milwaukee, Wis.**

**FOR STEADY SERVICE Beaver**



# Sullivan Equipment for the Rock Industry

## Sullivan Hammer Drills—Rotators

Sullivan Rotators are 38 lb. one-man, self-rotating hammer drills, equipped with steel retainer and automatic lubrication and requiring ⅞-inch solid or hollow drill steel. They are recommended for any drilling work encountered in highway or street construction, such as cutting trenches, deep drilling in quarries, block holing or horizontal toe hole work on high benches. In addition to several compressed air types, a steam drill is available. Rotators are noted for their great drilling speed, relative freedom from vibration and ability to stay on the job. Bulletin 2481-B.

## CONCRETE BREAKERS

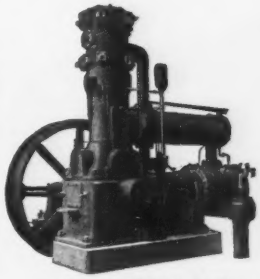
The Sullivan "DB-221" Concrete Breaker is a 65-lb., non-rotating hammer drill, intended for cutting asphalt or breaking up concrete pavements, walls, etc. It handles 1⅛-inch steel tools with either bull point or chisel edge. A steel retainer keeps the tool in position. The throttle is of the press-down lever type and is situated in the handle. The valve and piston motion gives a very powerful, snappy blow, and the tool operates with little vibration. Bulletin 2481-D.

## PNEUMATIC SPADERS

Sullivan Clay Spaders are light, but substantial, compressed air tools for taking the place of picks and shovels in excavating hard clay. For digging culverts or other underground work, a short steel spade is provided. For outdoor work in trenches, etc., a long shanked spade is furnished. The tool without the spade weighs only 16 lbs. and is one of the standard Sullivan non-rotating hammer drills, made from steel and drop forgings throughout. A knurled retaining bushing keeps the spade in the chuck. Bulletin 2470-X.

## Air Compressors

ANGLE-COMPOUND power driven compressors are economical of floor space and secure efficiency through exact balancing of reciprocating parts. For belt or direct connection; single or twin units, 400-3500 cu. ft., equipped with "WAFER" VALVES, total closure unloading valve, with high pressure relief. Three pass, counter current intercoolers give highest efficiency. Bulletin 2477-B.



Sullivan "WJ-3" Angle Compound Compressor

**Also Portable Hoists and Drill Sharpeners**

**SULLIVAN MACHINERY CO.**
**82 East Adams St. Chicago**

# It Is Net Results That Count!

The most positive proof of the efficiency of any machine is the testimony of the man on the job —the owner—for HE KNOWS from actual experience in his own quarry, where net results count. Here are a few reports from various parts of the country which prove that the ARMSTRONG ALL-STEEL BLAST HOLE DRILL is a Result-getter of the highest order.

### Made a New Record

**Portland, Colorado:** "Average for three days was 121⅓ feet per ten-hour day, operated by two men. This is a rate we have never before approached here."

### Solved His Blasting Problem

**San Francisco:** "It has solved our blasting problem in that we are able to break our material up finer, and it also eliminates a difficult labor problem by displacing a considerable number of men."

### Fulfilled Its Guarantee

**Salisbury, N. C.:** "Your machine fulfilled its guarantee here as well as at Stacey, by drilling an average of 13½ feet per day in our very hard granite."

### Makes a Big Saving

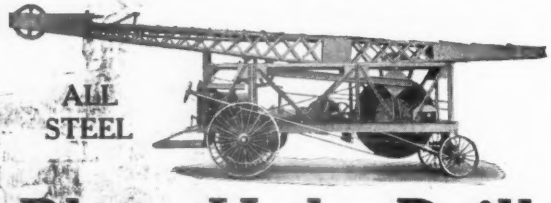
**New Braunfels, Texas:** "The all-steel construction and the wire line drilling device has made a big saving in the cost of our blast hole drilling. We congratulate you on the operation of this machine."

### 40% Under the Estimate

**Dixieland, Calif.:** "On 3100 feet of drilling our cost per ton is only three cents, and the cost per foot around 30 cents. That's 40% under your estimate."

The Armstrong All-Steel Blast Hole Drill will drill more hole at less cost than any other drill you have ever used.

# ARMSTRONG



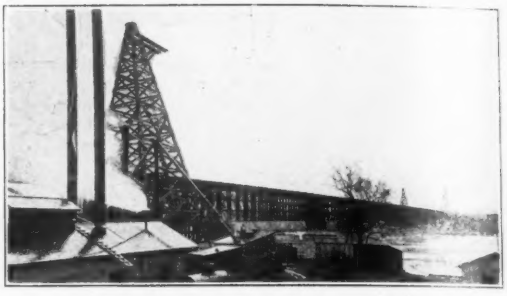

# Blast Hole Drill

**Want to cut your drilling costs? Write for descriptive literature and full particulars and make more money in 1924. Write today**

**Armstrong Manufacturing Co.**
**403 Chestnut Street Waterloo, Iowa**



# FLORY



# Cableways

There are hundreds of sand plants in the country where the name Flory is regarded as a definite symbol of care-free, dependable service.

At these plants there is just one test for a cableway, one standard by which all cableways must be judged —it is the Flory name.

Such united and fixed opinion is, of course, the greatest single asset of the company. It proves that we are serving friends instead of customers.

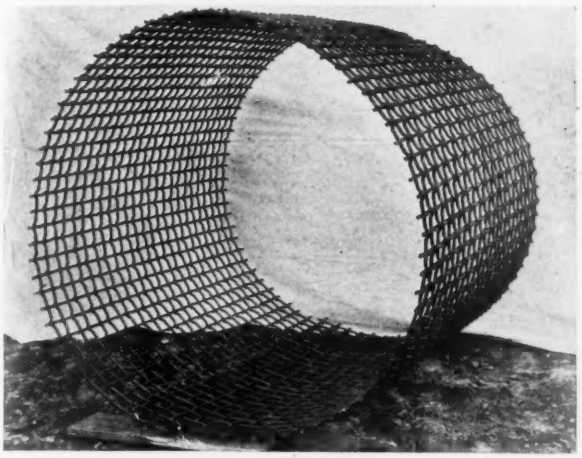
Our engineering department will assist you in solving your problem in the proper design for a cableway for sand plant or open quarry work.

Quarry and Mine Hoists, Steam, Electric and Gasoline, for every purpose.

**Write today**

**S. FLORY MFG. CO.**
**Bangor, Pennsylvania**
**New York, 95 Liberty Street**

# ROL-MAN Woven Manganese Steel Screens



48" dia., 4 feet long, 1½" opening, ⅜"dia. rods. 25 to 40% more free openings than a similar screen of perforated plate

**Rol-man** double lock mesh type of woven screen (patented) with both rods crimped and interlocked

**Prevents Displacement or Spreading of Mesh**

**Flat Screening Face**

**Maximum Production**

**Longest Life**

## MANGANESE STEEL FORGE CO.

**Richmond Street and Erie Avenue** **Philadelphia, Pennsylvania**

# KRAFT

## The Ideal Car Lining Paper

Our Kraft car-lining paper is tough, pliable, moisture-proof and light in weight.

Cost per pound is ***less*** than any other papers offered for ***car lining purposes,*** which are heavier in weight, with less strength, giving less protection than our lighter weight Kraft.

Put up in rolls of any width or diameter desired, eliminating waste, and making its use more convenient.

We will gladly quote prices and send samples of this unusual product, feeling confident we can ***reduce*** your paper costs ***one-third*** or more—because we give ***more yards per dollar.***

## W. A. JOHNS PAPER CO.

**327 South La Salle Street** **Chicago, Illinois**

# Sandvik STEEL BELT CONVEYOR

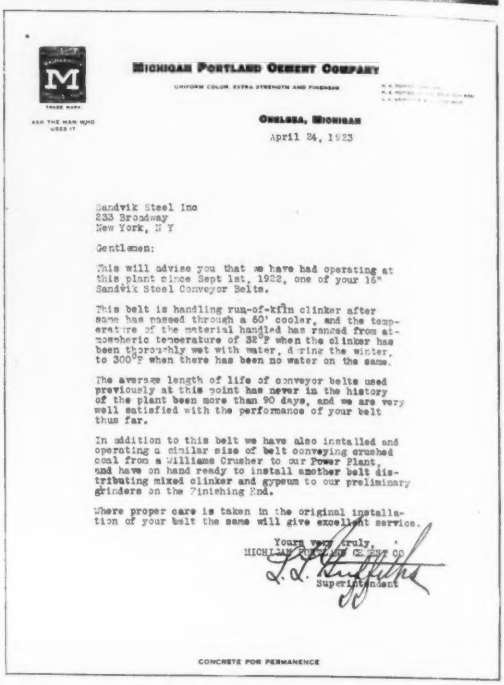
Sandvik Steel Conveyor Belts are made of high grade charcoal steel by a special process, and are cold rolled, hardened and tempered.

These belts will stand up better under ordinary wear, and are the only belts made that will successfully withstand scraping or ploughing of wet or plastic material.

Sandvik Belt Handling Hot Clinker at the Michigan Portland Cement Co.'s Plant

They are elastic, no power is consumed in bendings over terminal drums and idlers, they are simple in design, low in first cost and maintenance.

Write for our booklet. It contains interesting information.



MICHIGAN PORTLAND CEMENT COMPANY

UNIFORM COLOR, EXTRA STRENGTH AND FINENESS

ASK THE MAN WHO USES IT

CHELSEA, MICHIGAN

April 24, 1923

Sandvik Steel Inc
233 Broadway
New York, N Y

Gentlemen:

This will advise you that we have had operating at this plant since Sept 1st, 1922, one of your 16" Sandvik Steel Conveyor Belts.

This belt is handling run-of-kiln clinker after same has passed through a 60' cooler, and the temperature of the material handled has ranged from atmospheric temperature of 32°F when the clinker has been thoroughly wet with water, during the winter, to 300°F when there has been no water on the same.

The average length of life of conveyor belts used previously at this point has never in the history of the plant been more than 90 days, and we are very well satisfied with the performance of your belt thus far.

In addition to this belt we have also installed and operating a similar size of belt conveying crushed coal from a Williams Crusher to our Power Plant, and have on hand ready to install another belt distributing mixed clinker and gypsum to our preliminary grinders on the Finishing End.

Where proper care is taken in the original installation of your belt the same will give excellent service.

Yours very truly,
MICHIGAN PORTLAND CEMENT CO.
L. L. Superintendent

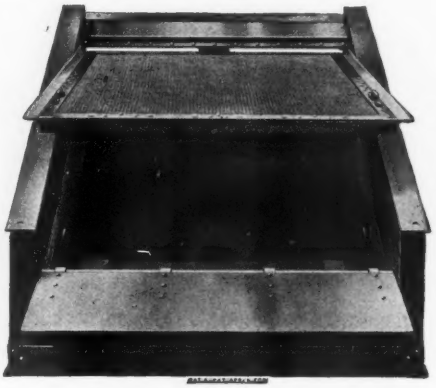
CONCRETE FOR PERMANENCE

**SANDVIK STEEL INC.**
**2001 Woolworth Bldg. New York City**

# Heavy Duty Moto-Vibro Screen

**FOR SAND, GRAVEL, CRUSHED STONE, ETC.**

**Coarse or Fine 1 to 3 Products**



**WET, DRY, DAMP**
**(within reasonable limits)**

**ASTONISHING CAPACITIES**

**ACCURATE OUTPUTS**

**INEXPENSIVE**

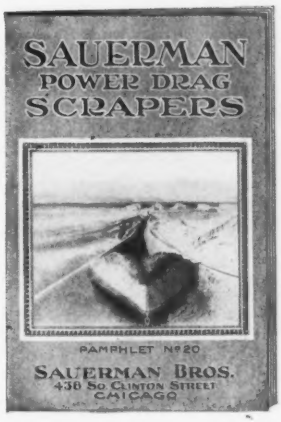
**SCREEN FRAMES CHANGED IN 5 MINUTES—NO SPECIAL CLOTH**

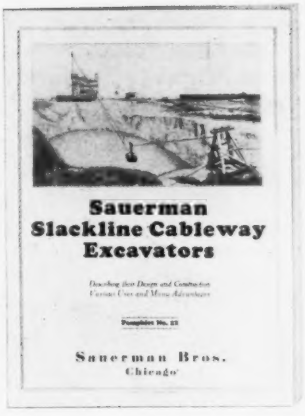
Intense vibration separates adhering sand from pebbles, breaks up sand "mats," prevents building on wire, wedging, and keeps meshes open.

Motor or belt driven, no auxiliaries. Simple, durable, accessible.

**STURTEVANT MILL CO.** HARRISON SQUARE **Boston, Mass.**

# Don't Delay! Send for These Booklets Today




THE above are not mere catalogs of equipment, but illustrate and describe money-saving methods of digging and moving materials. Practical solutions of many problems encountered in producing sand and gravel, stripping pits, storing and reclaiming coal, etc., are made clear by photographs and diagrams. We will send any or all of these pamphlets, without asking you to obligate yourself in any way, if you will just give us your name and address.

**Sauerman Bros., 430 South Clinton Street, Chicago, Illinois**

# BIG DAYS

## National Crushed Stone Association

**January 21-23 inclusive**
**STATLER HOTEL**
**St. Louis**

## National Sand and Gravel Association

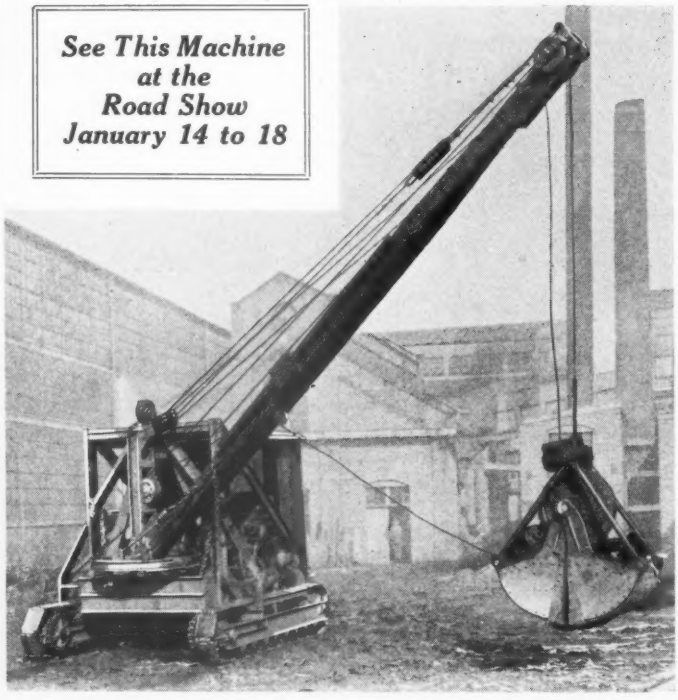
**January 22 and 23**
**CHASE HOTEL**
**St. Louis**

## Easton Car & Construction Co.

**Easton, Pa.**

# How's This For Balance?

*See This Machine at the Road Show January 14 to 18*



THIS bucket is filled chock full of steel castings as a test load, total weight 4250 pounds—a burden far in excess of any load you would ever pick up in actual operation.

Notice that the crane balance is as undisturbed as though the bucket were empty. And no outriggers are used either. It's a

**BYERS**

**Model "1" with Full "Cats"**

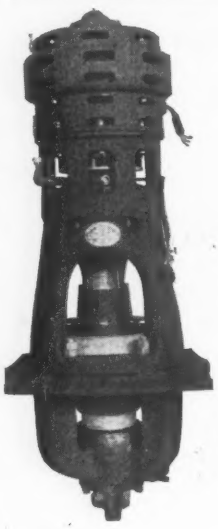
especially designed for the speedy handling of loose materials.

Users will tell you that "Speed Is Right." Speed in operation, speed in shifting position in close quarters or over loose ground, speed in total work done every season because of faithful day after day performance.

**Send for descriptive bulletin**

**The Byers Machine Company**
**310 Sycamore St. Ravenna, Ohio**

# The Weston Direct Drive Gyratory Crusher for Secondary Reduction of Hard Rock, Ore and Gravel



## Developed in a Granite Crushing Plant

This machine fills the need for a secondary crusher of large capacity and great strength for work in all friable rock.

The first machine, installed more than two years ago, has established remarkable records for capacity, low power consumption and general economy in operation. Later installations have more than proved all claims for the machine.

The construction is all-steel with Chrome-Vanadium forged steel shaft of large size, and with full-bearing eccentric, bronze bushed inside and out.

The entire machine is arranged to give freedom from costly delays. Positive lubrication without pumps—Dust prevention in bearings—Greater wear on manganese before replacement—Ease of adjustment and repair—and a sturdy oversize motor—All work to your advantage.

Crusher is simple in design and the best practice in modern Engineering is utilized. Built in six standard sizes to follow any primary, smallest machine can be set to ½" with large capacity.

Arranged for direct motor, or belt drive.

***Bulletin No. 25-A describes this machine in detail***

## THE MORGAN ENGINEERING COMPANY
**ALLIANCE, OHIO**

**Designers, Manufacturers and Contractors**
**Electric Traveling Cranes, Rolling Mill Machinery**
**Ordnance, Steel, Shipbuilding and Forging Plants Complete**
**Rock Crushers, Special Machinery for Any Purpose**

**Chicago**
**122 S. Michigan Ave.**

**Pittsburgh**
**1420 Oliver Bldg.**
**Birmingham, Ala.**
**Brown-Marx Bldg.**

# INDUSTRIAL CRANES

## 17 Locomotive Types—
## Capacities 5 to 200 Tons

Operating on rails, crawling tractor belts or broad gauge tractor wheels. For operation with clamshell or dragline bucket, magnet, grapple or hook and block. Readily convertible with attachments for shovel or pile driving operations.

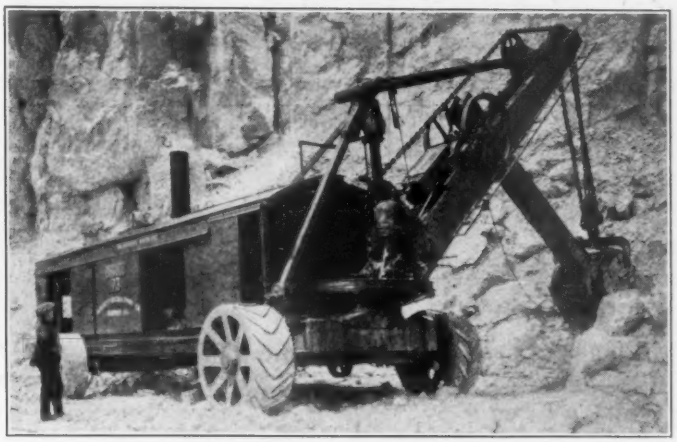
The product of the oldest and largest manufacturers of locomotive cranes in the country. Specialists in crane building for 50 years.

*Our Golden Anniversary Catalog, Fully Illustrating All Types, With Operating Data, Sent Immediately on Request*

INDUSTRIAL WORKS BAY CITY MICHIGAN

INDUSTRIAL CRANES

# UP-TO-DATE MACHINERY



OSGOOD 73—3½-yd. on Traction Wheels

is essential to the operation of modern business. You cannot afford to fool with obsolete equipment. OSGOOD Steam Shovels are the last word in steam shovel design. Labor saving devices and mechanical improvements are the result of years of practical steam shovel building. You will make no mistake on an OSGOOD.

A wide range of capacities on Continuous Tread, Traction or Railroad Mountings.

**1½ to 6 Cu. Yd. Railroad Type Steam Shovels.**

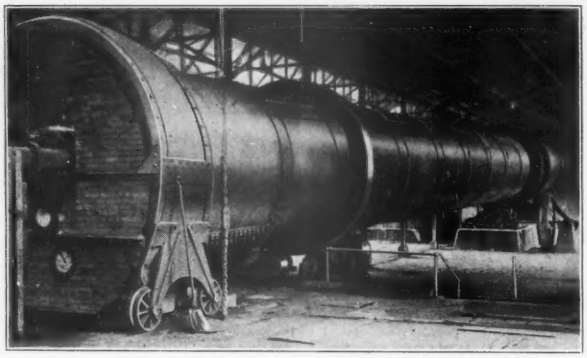
**¾-1-1¼ Cu. Yd. Revolving Steam Shovels, Clamshells, Draglines and Cranes.**

## The OSGOOD Company, Marion, Ohio, U. S. A.

# VULCAN PREDOMINATES!

## On the Track
## A Vulcan Locomotive

One of the Vulcan locomotives used by the United States Portland Cement Co. at Concrete, Colo. This is a 53½-ton six-wheel "Switcher," with 17" x 24" cylinders; 180 lbs. boiler pressure; 48" dia. driving wheels; 22,110 lbs. tractive force.



## At the Mill
## A Vulcan Kiln

9'0" dia. by 125'0" long, as installed in the Kiln Room of the same company. "Its performance is satisfactory in every way" is our report on this kiln.

New York Office
50 Church St.

**VULCAN IRON WORKS**
*Est. A. D. 1849*

1753 MAIN STREET
WILKES-BARRE, PA.

Chicago Office
McCormick Bldg.

# PRODUCTS ROCK and RUBBER

The aim of each quarryman is to get his products of rock in salable condition at the least possible expense.

And rubber is a large factor in keeping your operating and handling costs at a low point.

Our experience of nearly forty years enables us to supply you with the products that will show you economy.

We manufacture the following articles essential to the rock products field:

**BELTING for power transmission; conveying and elevating of materials**
**HOSE for every conceivable purpose: AIR DRILL, STEAM, WATER SUCTION, etc.**
**ROD and SHEET PACKINGS, GASKETS, PUMP VALVES, etc.**
**AUTOMOBILE TIRES and TUBES**

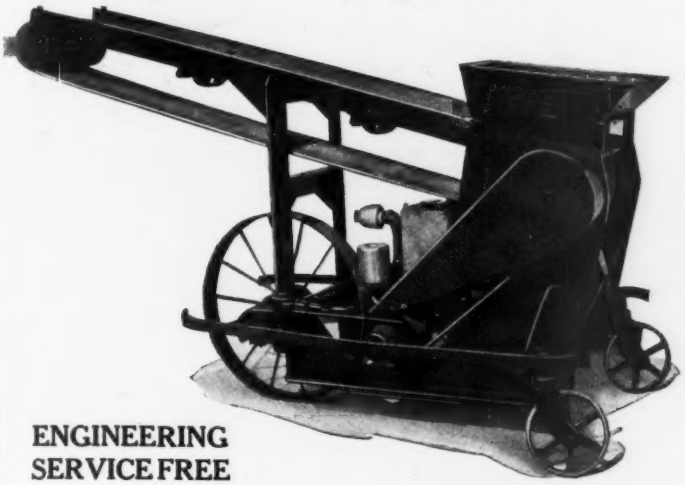
***Let us figure on your rubber requirements. We can serve you well***

## QUAKER CITY RUBBER COMPANY

**Main Office and Factory, Wissinoming, PHILADELPHIA, PA.**

**Branches: Chicago Pittsburgh New York**

# A Permanent Investment in LOADER SATISFACTION



ENGINEERING SERVICE FREE

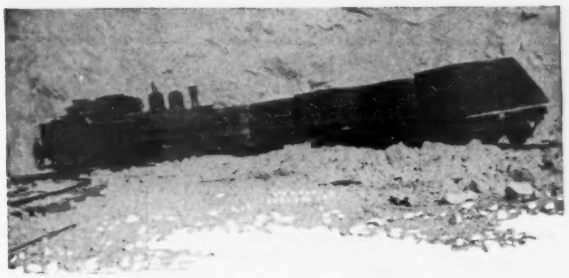
Every minute a loading gang is on your pay roll you are losing money. Every minute you are without an Ottumwa Box Car Loader you are paying a high price for inefficiency and waste.

This portable handy belt loader will load a box car as cheaply as an open car and is easily operated by only part time of one man. Nothing but roller and ball bearings throughout. Alemite greasing system; belt is carried on rollers to reduce power consumption and can be operated by a 2 or 3 h.p. gasoline engine or electric motor.

Replaces a whole loading gang and is always ready and willing for work.

Write for complete details.

MANUFACTURERS
OTTUMWA BOX CAR LOADER COMPANY, OTTUMWA IOWA.
BEST BOX CAR LOADERS AND UNLOADERS



# Why Do Shay Geared Locomotives Work On Lighter Rail?

A SHAY Geared Locomotive weighing 39 tons will haul the same tonnage as a rod engine and tender weighing 90 tons.

On each axle of this 90-ton rod engine is a 27,000 pound load.

The Shay, of the same power as the 90-ton rod engine, carries an approximate load of 19,000 pounds on each axle.

Because of its lighter axle load and absence of counterbalance, the Shay will operate on light rail, impossible for a rod engine of the same power.

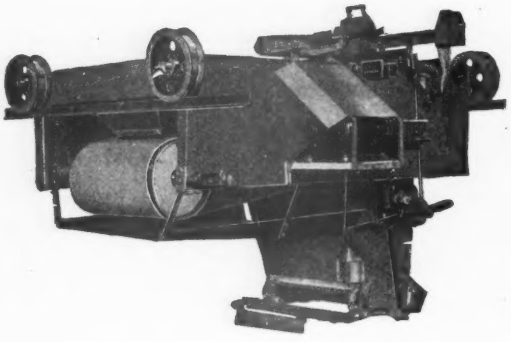
There are other details of Shay construction which save money for you. Let us explain them to you.

LIMA LOCOMOTIVE WORKS, Incorporated
Lima, Ohio 17 East 42nd Street, New York

LIMA
*Shay Geared* LOCOMOTIVES

# Maintain an Accurate Check on Your Materials

The only safe method of doing this is by weighing the materials at strategic points in the line of manufacture.



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**will give you accurate weights**

THIS SCALE IS SUITABLE FOR LIMESTONE, MARL, SAND, GYPSUM, CLINKER, CRUSHED ROCK, COAL, and similar materials.

Investigate it and learn where it can be used in your plant.

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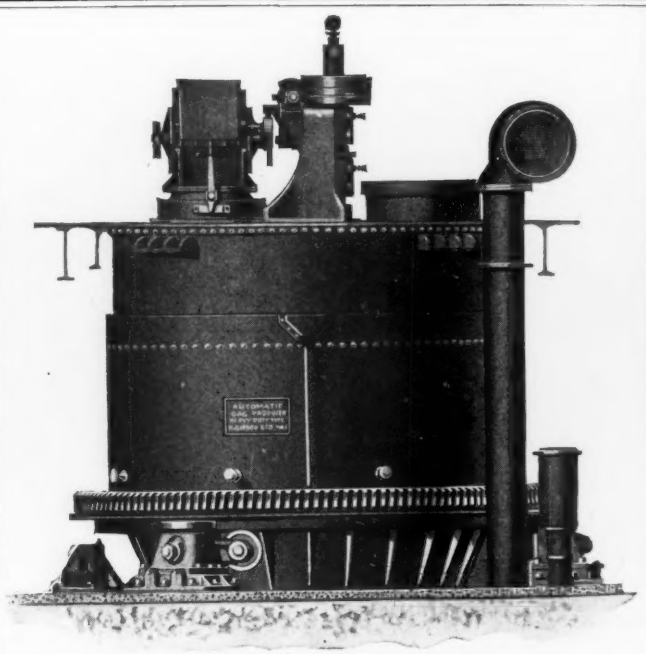
## WOOD AUTOMATIC GAS PRODUCERS

You know that more economical gas producers in your plant will soon pay for themselves and save you money.

R. D. Wood and Company's Automatic Gas Producers will do just that. They are strongly built, which insures low upkeep, and their special features effect greater gas production per ton of coal than the ordinary kinds.

*Used in Leading Lime Plants*

Our catalog gives details.
Mailed on Request.



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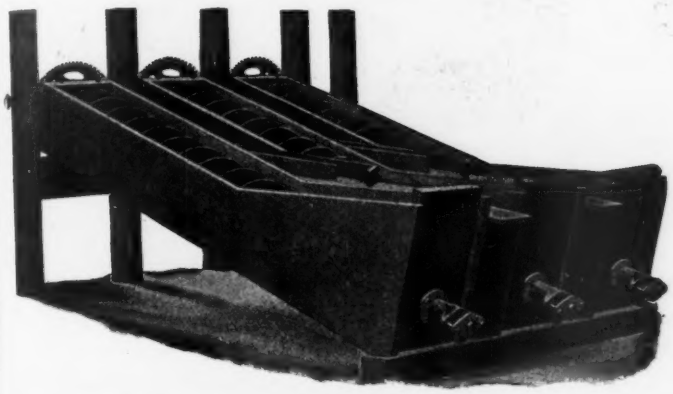

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**Lewistown, Pa.**

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reduce haulage costs. If at all skeptical write Mr. W. A. Keys of Brockwayville, Pa. (Operation shown in above cut) who reduced haulage cost per net ton from 80 cents to 15 cents; team haulage as compared with Brookville-Fordson.

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**All machines furnished in gauges 24" to 56½". Full information will be gladly furnished without obligation on your part.**

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Among the many desirable and exclusive features that help to make this the ideal bucket for the heavy work encountered in quarry service are:

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**A heavy duty two-part tooth constructed to give maximum service under the most severe digging conditions. The design insures rigidity of the tooth and eliminates any possibility of the point becoming loose or dropping off.**

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**FOUNDRIES: Chicago Heights, Ill.; New Castle, Del., and Oakland, Cal.**

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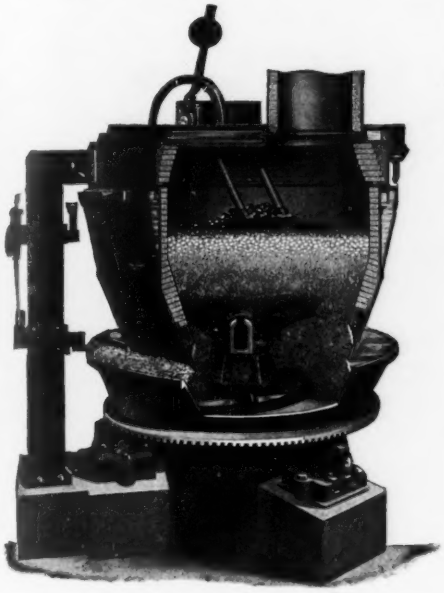

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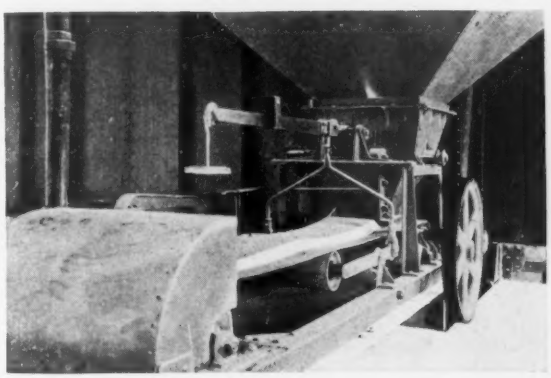
We are also prepared to fill orders for repair parts and spare parts for machines formerly built by C. & C. Electric & Mfg. Co., having purchased their records, patterns, drawings, special tools and equipment.



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Performance records yours for the asking.

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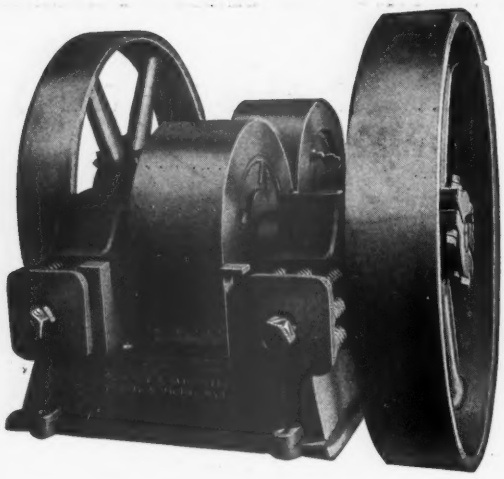

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Webb City & Carterville crushers, screens, elevator buckets, or transmission equipment have conspicuously demonstrated their superiority wherever they have been installed.

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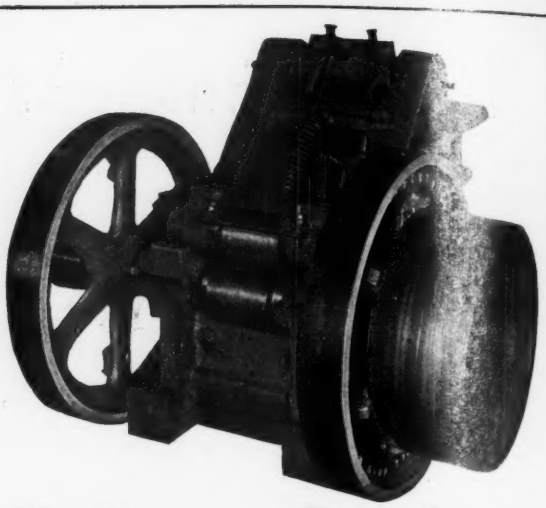

# Reliance Crushers

IN ALL SIZES FOR EITHER PORTABLE PLANTS FOR ROAD BUILDING OR STATIONARY QUARRY INSTALLATIONS.

BUILT FOR LONG, HARD SERVICE—WILL SAVE YOU MONEY IN THE LONG RUN

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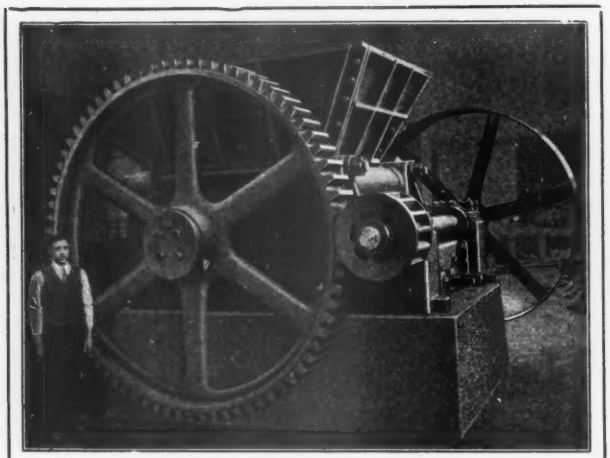
**Universal Road Machinery Co., Kingston, N. Y.**
Branches in all principal cities in U. S. and Canada
MANUFACTURERS OF THE FAMOUS RELIANCE LINE OF ROAD BUILDING AND QUARRY EQUIPMENT



If you had seen the McLanahan Single Roll Crusher before ordering your first Gyratory or Jaw Crusher, you would now be running only the McLanahan Crushers.

After many years' practical experience building and operating other crushers, we brought out the first Single Roll Crusher, proved it best, simplest and most economical—making least fines—requires but little head room—no apron or hand feeding—takes wet or slimy material.

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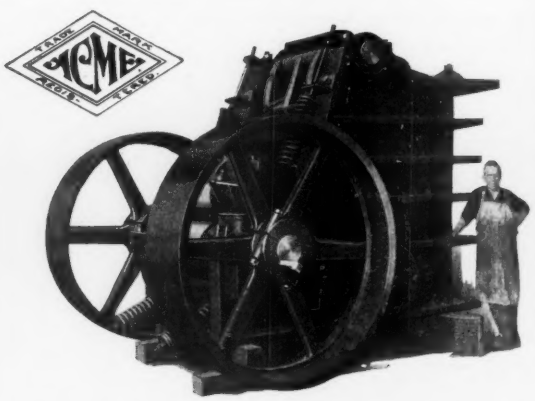


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## 6x10 to 42x48

We have in stock for immediate delivery sizes up to 30x36, one piece frame, and up to 26x40, four piece frame.

Diecast Genuine Removable Bearings

*Complete Quarry Equipment*
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Grinding cost in its last analysis includes not only cost of operation but also cost of maintenance. Actual tests by some of the large users of pulverizing machinery have shown that the

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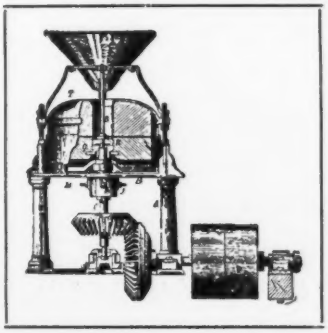

has lower maintenance costs

Is not the experience of these big users applicable to your grinding problems?

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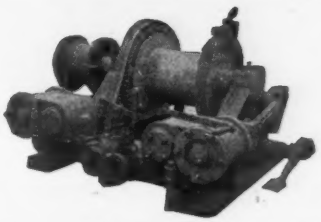

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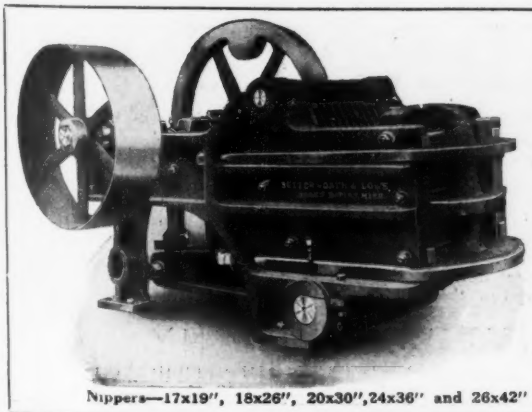

Nippers—17x19", 18x26", 20x30",24x36" and 26x42"

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For All Rocks and Ores Softer Than Granite

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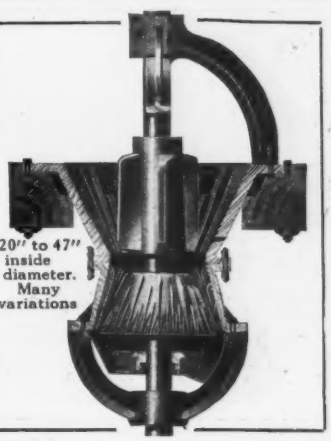
Special Crusher-Grinders for Lime



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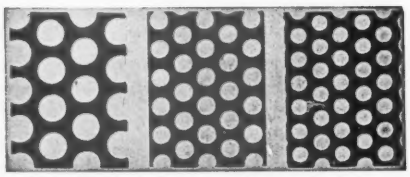

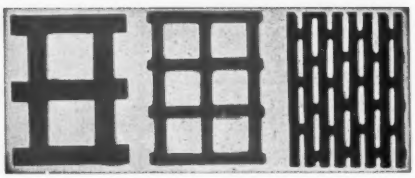

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Sheets furnished flat or rolled to shape for revolving screens.

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WHERE rails are light and tracks uneven—conditions under which most industrial locomotives must work — Baldwins are giving entire satisfaction.

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Years ago we helped our customers create a demand for their hydrate. Today the demand exceeds the supply. That's why every lime manufacturer should have an efficient, economical hydrating plant.

THE KRITZER Continuous Lime Hydrator is efficient in production and economical in operation and maintenance. Let us investigate exhaustively the local conditions peculiar to your proposition, and then apply our experience of many years and design a plant to meet those conditions.

*A KRITZER plant, scientifically adapted to your conditions, will give you the best product at lowest cost*

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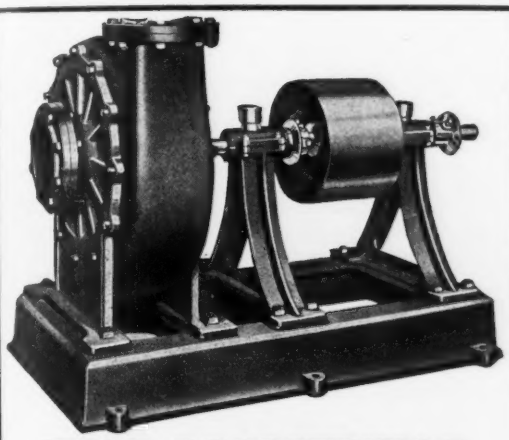

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Nothing ever lessens or decreases the wonderful reliability of the Lightning Pump—nothing short of wilful or wanton neglect. It has quality built into it, the quality that always brings it through a severe performance without backing or flinching, giving sand and gravel products an ideal service.

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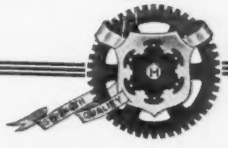

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Hill Friction Clutch Coupling (Smith Type) 9 H.P. to 1300 H.P. at 100 R.P.M.

The big, broad field of engineering is made up of those who make a specialty of some particular branch.

The Hill Clutch Company's engineers have made a study of the design and application of friction clutches for a period of 39 years.

You will be placed under no obligation in receiving our recommendations and quotations covering your customers' requirements.

Our Catalog No. 8 contains a lot of clutch data well worth having handy for reference. Copy will be mailed upon request.

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## "CARROLL" SOLID WELD STEAM SHOVEL CHAIN

Best refined iron, expert workmanship and most practical method of manufacture combined to produce the ultimate in high quality.

Recommended for heavy duty in rock work, stripping and all difficult excavation.

Long and continuous service is economical service.

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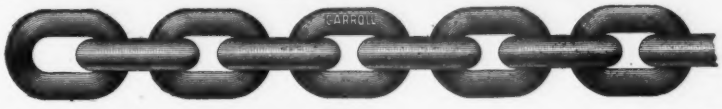
For use on Cranes, Draglines, etc., and Steam Shovels engaged in lighter work.

An exceptionally high grade chain that may be depended upon for strength and wear.

Uniform Links, perfectly welded, insure safety and satisfactory service.

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# ANCHOR BRAND COLORS

**For Mortar, Cement and Brick—**
**Brown, Black, Red and Buff**
**—Strongest and Most Durable**

Manufactured by

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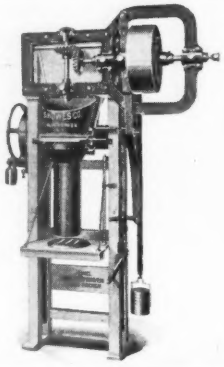
**For Cement, Lime, Talc and Many Other**

## Rock Products



Your plant deserves these modern, efficient machines. They answer your need for faster filling of sacks or barrels. They liberate men, save time, and wear for years under the most trying conditions.

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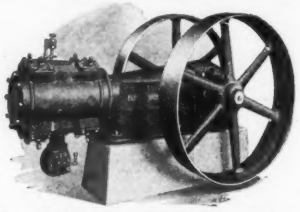

Send for Bulletin 104 describing our air compressors and Bulletin 202 showing our pumps.

When thinking and studying ways and means of improving your plant for next season's work, you will do well to consider our products.

Write your name and address on the margin of this paper, tear out and send to us.

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There are fewer parts used in the Seaverns than any other truck loader. There are but three levers to control the machine and it is so simple to handle skilled labor is not required.

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**Zepp Automatic Hydrator**
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***Efficiency of Operation—Low First Cost***

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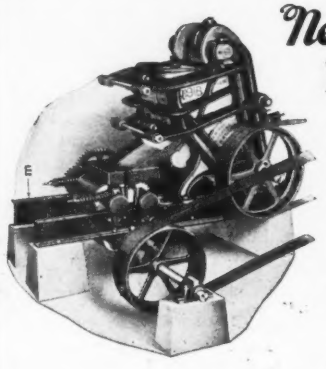

# *New Holland* Rock Crusher

New Holland Rock Crusher with Re-crushing Rolls is ideal to crush quarried rock, oversize from larger plants or gravel into fine grades or sand. Crushes by small degrees, producing minimum of dust. Requires small power and is subject to least possible wear. Write for catalog and prices on Crushers, Elevators and Screens.

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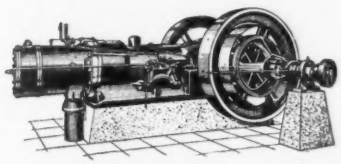
Roberts and Franklin Sts., New Holland, Pa., U. S. A.



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POWER STEERING by swinging the cab—the same principle which has proved so successful on traction wheel ERIES.

CLIMBS GRADES as steep as 30% (engineer's measurement).

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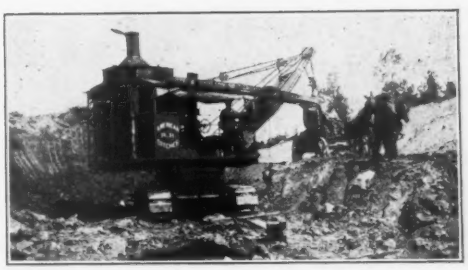

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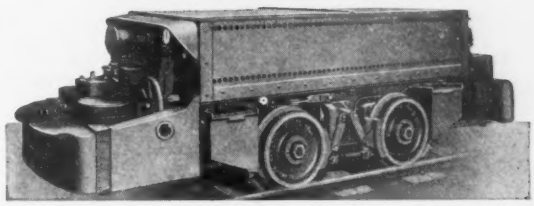

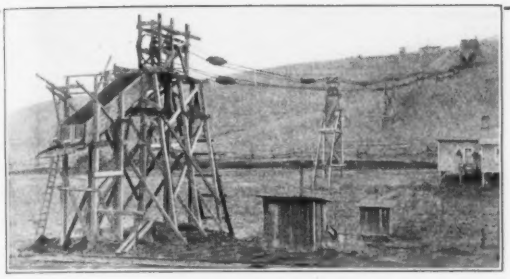

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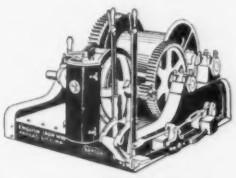

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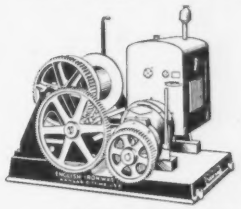

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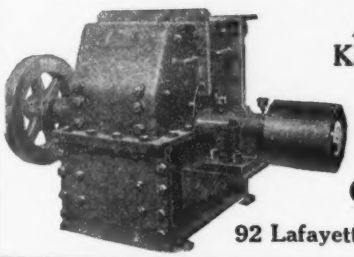

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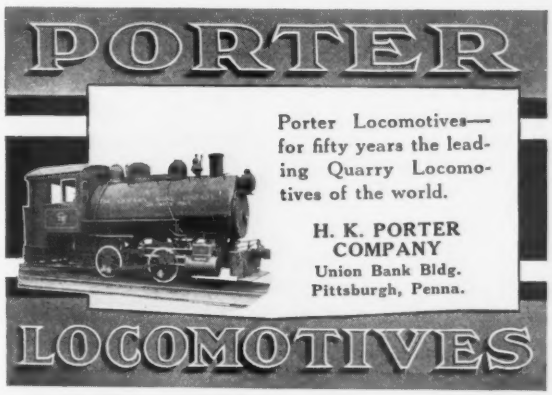


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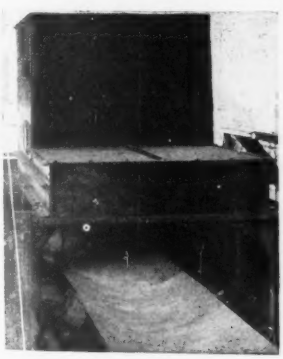

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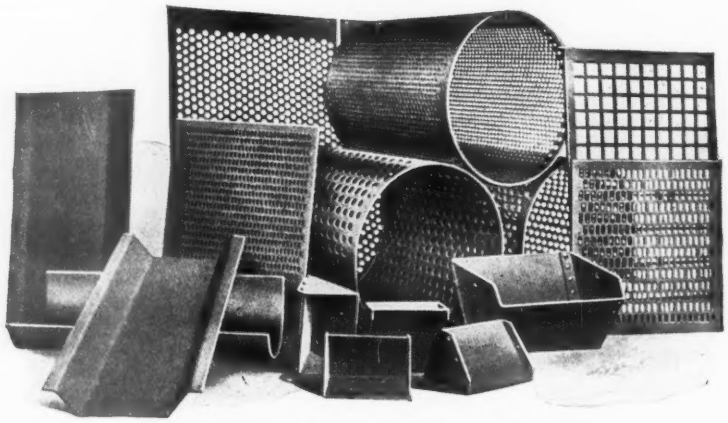

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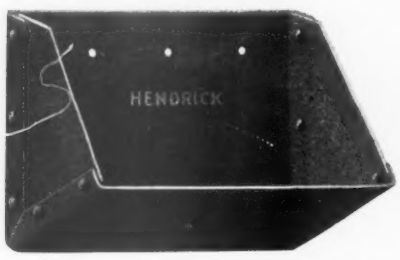

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Williamsport Wire Rope Co., Williamsport, Pa.

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The Dorr Co., New York, N. Y.
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
The Reeves Bros. Co., Alliance, O.—see page 38
F. L. Smidth & Co., New York, N. Y.—see page 195
Traylor Eng. & Mfg. Co., Allentown, Pa.—see pages 44 and 45

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Sturtevant Mill Co., Boston, Mass.—see page 182

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The Byers Machine Co., Ravenna, O.—see page 184
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The Hayward Co., New York, N. Y.
Jeffrey Manufacturing Co., Columbus, O.—see pages 46 and 47
Link-Belt Co., Chicago, Ill.—see page 152 and back cover
Northwest Engineering Co., Chicago, Ill.—see pages 3 and 4
Orton & Steinbrenner Co., Chicago, Ill.—see page 49
Portable Machinery Co., Passaic, N. J.
Webster Mfg. Co., Chicago, Ill.—see page 27
Weller Mfg. Co., Chicago, Ill.—see page 176

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Atlas Car & Mfg. Co., Cleveland, O.—see page 174
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The Byers Machine Co., Ravenna, O.—see page 184
Pawling & Harnischfeger Co., Milwaukee, Wis.—see page 34
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Hardinge Co., New York, N. Y.—see page 7
Los Angeles Foundry Co., Los Angeles, Cal.
Manganese Steel Forge Co., Philadelphia, Pa.—see page 181
Mine & Smelter Supply Co., Denver, Colo.—see page 59
Philadelphia Steel & Iron Co., Philadelphia, Pa.
F. L. Smidth and Co., New York, N. Y.—see page 195
Fuller-Lehigh Co., Fullerton, Pa.—see page 22
Standard Steel and Bearings, Inc., Philadelphia, Pa.
Steacy-Schmidt Mfg. Co., New York, N. Y.—cast iron, chilled steel
Tioga Steel & Iron Co., Philadelphia, Pa.—steel
Worthington Pump & Mach. Corp., New York—see pages 18 and 19

### BAR CUTTERS
Buffalo Forge Co., Buffalo, N. Y.

### BARGES
The Bucyrus Co., South Milwaukee, Wis.—steel—see page 20
Midland Barge Co., Midland, Pa.—steel

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The Ohio Corrugating Co., Warren, O.—steel
The Sandusky Cooperage & Lbr. Co. St. Louis, Mo.—see page 170
D. H. Stoll Co., Buffalo, N. Y.—steel
Traylor Eng. & Mfg. Co., Allentown, Pa.—see pages 44 and 45

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Manganese Steel Forge Co., Philadelphia, Pa.—see page 181
Philadelphia Steel & Iron Co., Philadelphia, Pa.
Wood Drill Works, Paterson, N. J.

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Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 14
H. W. Caldwell & Son Co., Chicago, Ill.—see page 153
Chain Belt Co., Milwaukee, Wis.
Dodge Mfg. Co., Mishawaka, Ind.—see page 162
General Electric Co., Schenectady, N. Y.—see pages 34 and 35
Hesse-Ersted Iron Works, Portland, Ore.
The Hill Clutch Co., Cleveland, O.—see page 195
Hyatt Roller Bearings Co., New York, N. Y.—all types
Kelmet Metals Co., Inc., Cleveland, O.
Jeffrey Mfg. Co., Columbus, O.—see pages 46-47
Link-Belt Co., Chicago, Ill.—see page 152 and back cover
Link-Belt Meese & Gottfried Co., San Francisco, Cal.
The Medart Co., St. Louis, Mo.
W. F. Mosser & Son, Allentown, Pa.
A. Plamondon Mfg. Co., Chicago, Ill.
Standard Steel and Bearings, Inc., Philadelphia, Pa.—ball
Webster Mfg. Co., Chicago, Ill.—see page 27
Weller Mfg. Co., Chicago, Ill.—see page 176

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Dodge Mfg. Co., Mishawaka, Ind.—see page 162
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Empire Tire & Rubber Corp. of N. J., Trenton, N. J.—transmission, conveying—see page 56
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Gandy Belting Co., Baltimore, Md.
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Imperial Belting Co., Chicago, Ill.—elevator, transmission, conveying
Jeffrey Mfg. Co., Columbus, O.—see pages 46 and 47
Link-Belt Co., Chicago, Ill.—canvas, leather, rubber and chain—see page 152 and back cover
Main Belting Co., Philadelphia, Pa.—fabric, canvas stitched, elevating, conveying
The Manhattan Rubber Mfg. Co., Passaic, N. J.—conveyor, elevator, transmission
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Mount Vernon Belting Co., Baltimore, Md.—fabric and canvas
National Leather Belting Co., New York, N. Y.—canvas stitched and leather conveying and transmission
N. Y. Belting & Packing Co., New York, N. Y.—see page 168
New York Rubber Co., New York, N. Y.—conveyor, elevator and transmission
Quaker City Rubber Co., Philadelphia, Pa.—conveyor, elevator and transmission—see page 186
The Republic Rubber Co., Youngstown, O.—conveyor, transmission
J. E. Rhoads & Son, Philadelphia, Pa.—leather
Robins Conveying Belt Co., New York, N. Y.—conveyor, elevator—see page 156
Rossendale-Reddaway Belting & Hose Co., Newark, N. J.—transmission, conveying
W. H. Salisbury & Co., Inc., Chicago, Ill.
Sandvik Steel, Inc., New York, N. Y.—steel conveying—see page 182
Stanley Belting Co., Chicago, Ill.—cotton belt
Sturtevant Mill Co., Boston, Mass.—chain transmission—see page 182
Union Engineering Co., Cleveland, Ohio—chain
Upson-Walton Co., Cleveland, O.—canvas
Victor Balata & Textile Co., New York, N. Y.—balata, canvas, solid woven
The Webster Mfg. Co., Chicago, Ill.—conveyor—see page 27
Weller Mfg. Co., Chicago, Ill.—see page 176

### BELT TIGHTENERS

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F. L. Smidth & Co., New York, N. Y.—see page 195

### BINS—Storage

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Atlas Engineering Co., Milwaukee, Wis.—portable and stationary
Austin-Western Road Machinery Co., Chicago, Ill.—see page 177
Bland Engineering Co., Minneapolis, Minn.—concrete
Blaw-Knox Co., Pittsburgh, Pa.—proportioning
The Brown Hoisting Machinery Co., Cleveland, O.—see page 1
Chain Belt Co., Milwaukee, Wis.
Chicago Bridge & Iron Co., Chicago, Ill.
Concrete Silo Co., Bloomfield, Ind.
Easton Car & Construction Co., Easton, Pa.—see page 183
The Galion Iron Works & Mfg. Co., Galion, O.
Gruendler Patent Crusher and Pulverizer Co., St. Louis, Mo.—rock, gravel, portable
Guarantee Construction Co., New York, N. Y.
Hendrick Mfg. Co., Carbondale, Pa.—see page 200
Jackson & Church Co., Saginaw, Mich.—see pages 40 and 41
Link-Belt Co., Chicago, Ill.—see page 152 and back cover
Littleford Bros., Cincinnati, O.—steel
MacDonald Engineering Co., Chicago, Ill.—concrete
The Petroleum Iron Works Co. of Ohio, Sharon, Pa.—steel
The Reeves Bros. Co., Alliance, O.—see page 38
Standard Steel Works, North Kansas City, Mo.
Steacy-Schmidt Mfg. Co., New York, N. Y.
Sturtevant Mill Co., Boston, Mass.—see page 182
Traylor Engineering & Mfg. Co., Allentown, Pa.—see pages 44 and 45
The Union Engineering Co., Cleveland, O.
Universal Road Machinery Co., Kingston, N. Y.—see page 192
Webster Mfg. Co., Chicago, Ill.—see page 27
Weller Mfg. Co., Chicago, Ill.—see page 176
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Wisconsin Bridge and Iron Works, N. Milwaukee, Wis.
The Youngstown Boiler & Tank Co., Youngstown O.—steel, all kinds

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Colonial Supply Co., Pittsburgh, Pa.
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The Ensign-Bickford Co., Simsbury, Conn.—see page 160
The Giant Powder Co., San Francisco, Cal.
The Grasselli Powder Co., Cleveland, O.—see page 161

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Illinois Powder Mfg. Co., St. Louis, Mo.

### BLASTING POWDER
(See Explosives)

### BLOCKS

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Jas. H. Channon Mfg. Co., Chicago, Ill.
Clyde Iron Works, Duluth, Minn.
The O. H. Davidson Equipment Co., Denver, Colo.
The Hill Clutch Co., Cleveland, O.—see page 195
Hyatt Roller Bearing Co., New York, N. Y.—pillow, roller bearing
A. Leschen & Sons Rope Co., St. Louis, Mo.—see page 29
Macwhyte Co., Kenosha, Wis.
The Medart Co., St. Louis, Mo.—pillow
Mining Machine Co., Mountville, Pa.—steel sheave
John A. Roebling's Sons Co., Trenton, N. J.
Upson-Walton Co., Cleveland, O.
Webster Mfg. Co., Chicago, Ill.—see page 27
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### BLOCK MACHINERY (Concrete)

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J. R. Alsing Engineering Co., New York, N. Y.
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American Gas Furnace Co., Elizabeth, N. J.
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Connersville Blower Co., Connersville, Ind.
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H. E. Wiedemann, St. Louis, Mo.

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Littleford Bros., Cincinnati, O.
Weber Chimney Co., Chicago, Ill.
Wiederholdt Construction Co., New York, N. Y.

**CHUTES**

Biehl Iron Works, Inc., Reading, Pa.
H. W. Caldwell & Son Co., Chicago, Ill.—see page 153
C. S. Card Iron Works, Denver, Colo.
Chain Belt Co., Milwaukee, Wis.
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The Good Roads Machinery Co., Inc., Kennett Square, Pa.—see page 164.
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Colorado Iron Works Co., Denver, Colo.
Deister Machine Co., Fort Wayne, Ind.
Denver Engineering Works Co., Denver, Colo.
The Dorr Co., New York, N. Y.
Joshua Hendy Iron Works, San Francisco, Calif.
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.—see page 172
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Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Wahl, The H. R. Co., Chicago, Ill.

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H. W. Caldwell & Son Co., Chicago, Ill.—see page 153
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Cutler-Hammer Mfg. Co., Milwaukee, Wis.—magnetic
Dodge Mfg. Co., Mishawaka, Ind.—see page 162
The Hanson Clutch & Machinery Co., Tiffin, O.—friction
Hesse-Ersted Iron Works, Portland, Ore.
The Hill Clutch Co., Cleveland, O.—see page 195
W. A. Jones Foundry & Machine Co., Chicago, Ill.
Link-Belt Co., Chicago, Ill.—friction, see page 152 and back cover
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
The Medart Co., St. Louis, Mo.
O. K. Clutch & Mfg. Co., Columbia, Pa.—friction.
Plamondon Mfg. Co., Chicago, Ill.

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Weller Mfg. Co., Chicago, Ill.—see page 176
Western Eng. & Mfg. Co., Chicago, Ill.

**COAL**

Amherst Fuel Co., Cincinnati, O.
Bertha-Consumers Co., Pittsburgh, Pa.
Maher Collieries Co., Cleveland, O.—"Marcoal"

**COAL PULVERIZING EQUIPMENT**

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American Pulverizer Co., St. Louis, Mo.
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L. R. Christie Co., Pittsburgh, Pa.—see page 48
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Gruendler Pat. Cr. & Pulv. Co., St. Louis, Mo.
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Orton & Steinbrenner Co., Chicago, Ill.—see page 49
Raymond Bros. Impact Pulverizer Co., Chicago, Ill.—see pages 24-25
Ruggles-Coles Engineering Co., York, Pa.
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E. H. Stroud & Co., Chicago, Ill.
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Williams Pat. Cr. & Pulv. Co., St. Louis, Mo.—see inside front cover

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**COMPRESSORS—(Air)**

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Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 14
American Air Compressor Works, Brooklyn, N. Y.
American Steam Pump Co., Battle Creek, Mich.
Beckwith Machinery Co., Pittsburgh, Pa.
Buhl Machine Co., Chicago, Ill.—portable stationary
Bury Compressor Co., Erie, Pa.
Chicago Pneumatic Tool Co., New York, N. Y.—portable, stationary
Curtis Pneumatic Machinery Co., St. Louis, Mo.—see page 43
DeLaval Steam Turbine Co., Trenton, N. J.
The Denver Rock Drill Mfg. Co., Denver, Colo.—portable—see page 60
Fairbanks, Morse & Co., Chicago, Ill.
Gardner Co., Quincy, Ill.
General Electric Co., Schenectady, N. Y.—see page 34-35
Ingersoll-Rand Co., New York, N. Y.
Manning, Maxwell & Moore, Inc., New York, N. Y.
Norwalk Iron Works, South Norwalk, Conn.—all kinds
Novo Engine Co., Lansing, Mich.
Pennsylvania Pump & Compressor Co., Easton, Pa.—see page 196
Schramm, Inc., West Chester, Pa.
Smokeless Oil Burner Co., Bucyrus, O.—see inside back cover
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**CONCENTRATORS**

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Denver Engineering Works Co., Denver, Colo.
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Magnetic Mfg. Co., Milwaukee, Wis.
McLanahan-Stone Machine Co., Hollidaysburg, Pa.—see page 192
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Ruggles-Coles Engineering Co., New York, N. Y.
Southwestern Engineering Co., Los Angeles, Calif.
Stearns-Rogers Mfg. Co., Denver, Colo.
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**CONCRETE WATERPROOFING**

Cal Chemical Co., Hagerstown, Md.

**CONES—(Sand)**

The Allen Cone Co., El Paso, Texas—for dewatering, sand washing, stockpile building, classifying, thickening, etc.
W. H. K. Bennett, M.E., Chicago, Ill.
Link-Belt Co., Chicago, Ill.—see page 152 and back cover
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
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Brown Instrument Co., Philadelphia, Pa.
Equitherna Control Corp., New York, N. Y.
Foxboro Co., Inc., Foxboro, Mass.
General Electric Co., Schenectady, N. Y.—see pages 34-35
Kieley & Mueller, New York, N. Y.
Leeds and Northrup Co., Philadelphia, Pa.
Powers Regulator Co., Chicago, Ill.
Thwing Instrument Co., Philadelphia, Pa.
Wilson Maulen Co., New York, N. Y.

**CONTROLLERS—Electric**

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 14
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Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 14
Atlas Engineering Co., Milwaukee, Wis.
Earle C. Bacon, Inc., New York, N. Y.
Barber-Greene Co., Aurora, Ill.—self-propelled and belt
The C. O. Bartlett & Snow Co., Cleveland, O.
Bland Engineering Co., Minneapolis, Minn.
B. and W. Oil-less Conveyor Co., Chicago, Ill.
The Brown Hoisting Machinery Co., Cleveland, O.—belt and chain—see page 1
C. G. Buchanan Co., Inc., New York, N. Y.—see page 159
H. W. Caldwell & Son Co., Chicago, Ill.—see page 153
Chain Belt Co., Milwauke, Wis.
Conveyors Corp. of America, Chicago, Ill.—steam jet, monorail, cableway
Dodge Mfg. Corp., Mishawaka, Ind.—see page 162
J. B. Ehrsam & Sons Mfg. Co., Enterprise, Kans.
Exeter Machine Works, Inc., West Pittston, Pa.
Fairmont Mining Machinery Co., Fairmont, W.Va.
Gifford-Wood Co., Hudson, N. Y.—all kinds.
The Godfrey Conveyor Co., Elkhart, Ind.
B. F. Goodrich Rubber Co., Akron, O.
Goodyear Tire & Rubber Co., Akron, O.
Good Roads Machinery Co., Inc., Kennett Square, Pa.—see page 164
The Greenville Mfg. Co., Greenville, O.—belting, carriers, return rollers, machinery for belt conveyors, etc.
Grindle Fuel Equipment Co., Harvey, Ill.
Gruendler Patent Crusher & Pulverizer Co., St. Louis, Mo.
Guarantee Construction Co., New York, N. Y.—pneumatic, belt and flight
The Geo. Haiss Mfg. Co., New York, N. Y.—portable, belt
The Hamilton Mfg. Co., Columbus, O.—portable stripping
Hesse-Martin Iron Works, Portland, Ore.
Howe Chain Co., Muskegon, Mich.
C. W. Hunt & Co., Inc., W. New Brighton, N.Y.
Iowa Mfg. Co., Cedar Rapids, Ia.
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W. A. Jones Foundry & Machine Co., Chicago, Ill.
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.—belt—see page 172
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Lewistown Foundry & Machine Co., Lewistown, Pa.—see page 189
Link-Belt Co., Chicago, Ill.—screw, portable, helicoid and belt—see page 152 and back cover
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
McKinney-Harrington Co., North Chicago, Ill.—steel bucket and portable
McLanahan-Stone Machine Co., Hollidaysburg, Pa.—see page 192
W. F. Mosser & Son, Allentown, Pa.—screw
National Conveying Equipment Corp., Chicago, Ill.—portable
Northern Conveyor & Mfg. Co., Milwaukee, Wis.—portable
The Orrville Simpson Co., Cincinnati, O.
Ottumwa Box Car Loader Co., Ottumwa, Ia.—flexible—see page 187
Portable Machinery Co., Passaic, N. J.—portable, belt
Robins Conveying Belt Co., New York, N. Y.—see page 156
Sandvik Steel, Inc., New York, N. Y.—see page 182
James B. Seaverns, Chicago, Ill.—pan—see page 196
Smith Engineering Works, Milwaukee, Wis.—see page 176
Specialty Engineering Co., Philadelphia, Pa.—belt
Steacy-Schmidt Mfg. Co., York, Pa.
The Stearns Conveyor Co., Cleveland, O.—belt, apron, screw and drag
Stearns-Roger Mfg. Co., Denver, Colo.
Stephens-Adamson Mfg. Co., Aurora, Ill.—see page 150
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The Sunbury Mfg. Co., Sunbury, O.
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Godfrey Conveyor Co., Elkhart, Ind.
Guarantee Constr. Co., New York, N. Y.
Holly Pneumatic Systems, Inc., New York, N. Y. (pneumatic)

### CONVEYING SYSTEMS—(Pneumatic)

Allen Eng. & Mfg. Co., Savannah, Ga.

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The Cleveland Rock Drill Co., Cleveland, O.
DeLaval Steam Turbine Co., Trenton, N. J.
Dixon Valve and Coupling Co., Philadelphia, Pa.
S. R. Dresser Mfg. Co., Bradford, Pa.—steel pipe
The Electric Controller & Mfg. Co., Cleveland, O.—flexible
Falk Corp., Milwaukee, Wis. (flexible)—see page 157
Faweus Machine Co., Pittsburgh, Pa.
Foote Bros. Gear and Machine Co., Chicago, Ill.
The B. F. Goodrich Co., Akron, O.
Hardscog Wonder Drill Co., Ottumwa, Ia.
Hesse-Ersted Iron Works, Portland, Ore.
The Hill Clutch Co., Cleveland, O.—see page 195
Ingersoll-Rand Co., New York, N. Y.
W. A. Jones Foundry & Machine Co., Chicago, Ill.
The Knox Manufacturing Co., Philadelphia, Pa.—see page 17
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The Medart Co., St. Louis, Mo.
Mulconroy Co., Inc., Philadelphia, Pa.—hose
R. D. Nuttall Co., Pittsburgh, Pa.
O. K. Clutch & Machinery Co., Columbus, Pa.
A. Plamondon Mfg. Co., Chicago, Ill.
Rubber Insulated Metals Corp., New York, N. Y.
Smith and Serrell, Newark, N. J.
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Bay City Dredge Works, Bay City, Mich.—gasoline, clamshell
Bay City Foundry & Machine Co., Bay City, Mich.—motor truck
Bedford Foundry & Machine Co., Bedford, Ind.
Birmingham Rail & Locomotive Co., Birmingham, Ala.
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The Hayward Co., New York, N. Y.—gantry
Industrial Works, Bay City, Mich.—steam, gas, crawling, tractor, locomotive, drag-line operation—see page 185
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Morgan Engineering Co., Alliance, O.—overhead traveling gantry and jib—see page 184
Northern Engineering Works, Detroit, Mich.—electric traveling, monorail, grab bucket
Northwest Engineering Co., Chicago, Ill.—crawler, gasoline, electric—see pages 3-4
Ohio Locomotive Crane Co., Bucyrus, O.—locomotive—see page 198
Orton & Steinbrenner Co., Chicago, Ill.—see page 49
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Pawling and Harnischfeger Co., Milwaukee, Wis.—portable crawler, gantry and overhead—see page 39
Penn Bridge Co., New York, N. Y.—gasoline tractor

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The Universal Crane Co., Cleveland, O.—motor truck and railroad flat car
The Wellman-Seaver-Morgan Co., Cleveland, O.—special
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The Stevenson Co., Wellsville, O.
E. H. Stroud & Co., Chicago, Ill.

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Hayward Co., New York, N. Y.
Insley Mfg. Co., Indianapolis, Ind.
Joshua Hendy Iron Works, San Francisco, Calif.
Lidgerwood Mfg. Co., New York, N. Y.—steel and wood
J. S. Mundy Hoisting Engine Co., Newark, N. J.
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### DIPPERS—(Steam Shovel)
(See Manganese Steel)

American Manganese Steel Co., Chicago Heights, Ill.—see page 190
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### DIPPER TEETH
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The American Mine Door Co., Canton, O.
Conveyors Corp. of America, Chicago, Ill.—air-tight

### DRAGLINES

Austin Machinery Corp., Toledo, O.
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Erie Steam Shovel Co., Erie, Pa.—see page 197
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Marion Steam Shovel Co., Marion, O.—see pages 8-9
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Northwest Engineering Co., Chicago, Ill.—see pages 3-4
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### DRAGLINE CABLEWAY EXCAVATORS

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Cableway Excavator Co., Fernwood, Pa.
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Indianapolis Cable Excavator Co., Indianapolis, Ind.
Lidgerwood Mfg. Co., New York, N. Y.
Link-Belt Co., Chicago, Ill.—see page 152 and back cover
Mansfield Eng. Co., Indianapolis, Ind.
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### DRAG SCRAPERS

Beach Mfg. Co., Charlotte, Mich.
Cable Excavator Co., Fernwood, Pa.
Godfrey Conveyor Co., Elkhart, Ind.
L. P. Green, Chicago, Ill.
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### DREDGES

Austin Machinery Corp., Toledo, O.
Bay City Dredge Works, Bay City, Mich.—dipper and dragline
W. H. K. Bennett, M.E., Chicago, Ill.
Bucyrus Co., South Milwaukee, Wis.—dipper, hydraulic, elevator—see page 20
Ellicott Machine Corp., Baltimore, Md.—hydraulic, chain, bucket
S. Flory Mfg. Co., Bangor, Pa.—see page 180
Hadfield-Penfield Steel Co., Bucyrus, O.—see page 171
The Hayward Co., New York, N. Y.—steam
Lidgerwood Mfg. Co., New York, N. Y.
The Marion Steam Shovel Co., Marion, O.—see pages 8-9
Morris Machine Works, Baldwinsville, N. Y.—hydraulic—see page 43
J. S. Mundy Hoisting Engine Co., Newark, N. J.
The Norbom Engineering Co., Darby, Pa.—hydraulic
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Stearns-Roger Mfg. Co., Denver, Colo.
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### DREDGE and PIPE SLEEVES

W. H. K. Bennett, M.E., Chicago, Ill.
Berry Flexible Pipe Joint Co., Philadelphia, Pa.
Cincinnati Rubber Mfg. Co., Cincinnati, O.
S. R. Dresser Mfg. Co., Bradford, Pa.
S. Flory Mfg. Co., Bangor, Pa.—see page 180
The B. F. Goodrich Rubber Co., Akron, O.
Knox Mfg. Co., Philadelphia, Pa.—see page 17
New York Rubber Co., New York, N. Y.
United Iron Wks., Inc., Kansas City, Mo.—see page 13

### DRILLS—(Tripod and Hammer)

Buffalo Forge Co., Buffalo, N. Y.
Champion Blower & Forge Co., Lancaster, Pa.
Chicago Pneumatic Tool Co., New York, N. Y.
The Cleveland Rock Drill Co., Cleveland, O.
Cochise Machine Co., Los Angeles, Calif.

***There is no other journal that gives you market prices and quotations of the various materials produced by this industry. That service alone signals the leadership of ROCK PRODUCTS.***

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### DRILLS—Blast Hole

The American Well Works, Aurora, Ill.
Armstrong Mfg. Co., Waterloo, Ia.—see page 180
Howells Mining Drill Co., Plymouth, Pa.—see page 197
Keystone Driller Co., Beaver Falls, Pa.
Loomis Machine Co., Tiffin, O.—see page 30
Sanderson-Cyclone Drill Co., Orrville, O.—see page 21
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The American Well Works, Aurora, Ill.
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Fred A. Gill, Lebanon, Pa.
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Pawling & Harnischfeger Co., Milwaukee, Wis.—see page 39
Sanderson Cyclone Drill Co., Orrville, O.—see page 21
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### DRILL STEEL SHARPENING MACHINES

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Hardscog Wonder Drill Co., Ottumwa, Ia.
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H. W. Caldwell & Son Co., Chicago, Ill.—see page 153
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Dodge Mfg. Co., Mishawaka, Ind.—see page 162
Fawcus Machine Co., Pittsburgh, Pa.
Foote Bros. Gear and Machine Co., Chicago, Ill.
Frost Drive Co., Worcester, Mass.—short center belt
The Hill Clutch Co., Cleveland, O.—rope—see page 195
Jeffrey Mfg. Co., Columbus, O.—see pages 46-47
W. A. Jones Foundry and Machine Co., Chicago, Ill.
Link-Belt Co., Chicago, Ill.—see page 152 and back cover
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
The Medart Co., St. Louis, Mo.
Morse Chain Co., Ithaca, N. Y.—chain
Poole Engineering & Machine Co., Baltimore, Md.
F. L. Smidth & Co., New York, N. Y.—see page 195
Weller Mfg. Co., Chicago, Ill.—see page 176
Western Valve Bag Co., Chicago, Ill.—gear and silent chain

### DRUMS

The Cleveland Steel Barrel Co., Cleveland, O.—grease
Draper Mfg. Co., Cleveland, O.
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.—see page 172
The Ohio Corrugating Co., Warren, O.—steel
D. H. Stoll Co., Buffalo, N. Y.
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### DRYERS—Rotary

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The C. O. Bartlett and Snow Co., Cleveland, O.
The Bonnot Co., Canton, O.—rotary direct fired
Buckeye Dryer Co., Chicago, Ill.—see page 32
Colorado Iron Works, Denver, Colo.
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The Denver Engineering Works Co., Denver, Colo.
Duff Patents Co., Inc., Pittsburgh, Pa.
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Glamorgan Pipe & Foundry Co., Lynchburg, Va.
Grindle Fuel Equipment Co., Harvey, Ill.
Gruendler Patent Crusher & Pulverizer Co., St. Louis, Mo.
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Joshua Hendy Iron Works, San Francisco, Calif.
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Hetherington & Berner, Indianapolis, Ind.—sand
Hyde & Co., Pittsburgh, Pa.—sand
Indiana Foundry Co., Inc., Indiana, Pa.—sand
The Jeffrey Mfg. Co., Columbus, O.—see pages 46 and 47
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.—see page 172
Lewistown Foundry & Machine Co., Lewistown, Pa.—see page 189
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McGann Manufacturing Co., Inc., York, Pa.—see page 15
McLanahan Stone Machine Co., Hollidaysburg, Pa.—see page 192
W. F. Mosser & Son, Allentown, Pa.
The Reeves Bros. Co., Alliance, O.—see page 38
Ruggles-Coles Engineering Co., New York, N. Y.
Steacy-Schmidt Mfg. Co., New York, N. Y.
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Allen Engineering Mfg. Co., Savannah, Ga.
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Buckeye Blower Co., Columbus, O.
Buffalo Forge Co., Buffalo, N. Y.
Clark Dust Collecting Co., Chicago, Ill.
Federal Pneumatic Systems, Inc., Chicago, Ill.
Rubert M. Gay Co., New York,, N. Y.—see page 193
Gruendler Patent Crusher & Pulverizer Co., St. Louis, Mo.
Holly Pneumatic Systems, Inc., New York, N. Y.
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.—see page 172
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Steacy-Schmidt Mfg. Co., New York, N. Y.
E. H. Stroud and Co., Chicago, Ill.
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Kuhlman Electric Co., Bay City, Mich.—transformers
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The Reliance Electric & Engineering Co., Cleveland, O.
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The C. O. Bartlett & Snow Co., Cleveland, O.
Bland Engineering Co., Minneapolis, Minn.
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Cham Belt Co., Milwaukee, Wis.
J. B. Ehrsam & Sons Mfg. Co., Enterprise, Kan.
Exeter Machine Works, Inc., West Pittston, Pa.
The Galion Iron Works & Mfg. Co., Galion, O.
Gifford-Wood Co., Hudson, N. Y.
Good Roads Machinery Co., Inc., Kennett Square, Pa.—see page 164
The Greenville Mfg. Co., Greenville, O.
Gruendler Patent Crusher & Pulverizer Co., St. Louis, Mo.

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***And ROCK PRODUCTS, who serves you both.***

***We can serve you each better if when you write to advertisers you say you saw it in ROCK PRODUCTS.***

Guarantee Construction Co., New York, N. Y.
George Haiss Mfg. Co., Inc., New York, N. Y.
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Earle C. Bacon, Inc., New York, N. Y.
W. H. K. Bennett, M. E., Chicago, Ill.
Besser Sales Co., Chicago, Ill.—concrete products plants
Bland Eng. Co., Minneapolis, Minn.
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C. G. Buchanan Co., Inc., New York, N. Y.—see page 159
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Chicago Engineering Associates, Chicago, Ill.
L. R. Christie Co., Pittsburgh, Pa.—see page 49
E. W. Cooper, Nashville, Tenn.
Waller Crow., Inc., Chicago, Ill.
Deavitt Laboratories, Chicago, Ill.—chemical
Denver Engineering Works Co., Denver, Colo.
The Dorr Co., New York, N. Y.
J. B. Ehrsam & Sons, Enterprise, Kan.—gypsum and gypsum plaster plant
Exeter Machine Works, Inc., West Pittston, Pa.
The Foundation Co., New York, N. Y.
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Guarantee Construction Co., New York, N. Y.
Gruendler Pat. Cr. & Pulv. Co., St. Louis, Mo.
Geo. Haiss Mfg. Co., New York, N. Y.
Hardinge Co., New York, N. Y.—see page 7
James N. Hatch, Chicago, Ill.
Hetherington & Berner, Inc., Indianapolis, Ind.
Hill Clutch Co., Cleveland, O.—see page 195
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Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.—see page 172
Kritzer Co., Chicago, Ill.—see page 194
Krogh Pump & Machinery Co., San Francisco, Calif.
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Link-Belt Co., Chicago, Ill.—sand, gravel, stone, lime, etc.—see page 152 and back cover
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Rogers Foundry & Mfg. Co., Joplin, Mo.
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Anderson Foundry & Machine Co., Anderson, Ind.—oil
The Automatic Furnace Co., Dayton, O.—steam
Earle C. Bacon, Inc., New York, N. Y.—hoisting
Bates Machine & Tractor Co., Joliet, Ill.—gasoline
Beaver Mfg. Co., Milwaukee, Wis.—see page 179
The Brownell Co., Dayton, O.—steam
The Buckeye Machine Co., Lima, O.—oil
The Buda Co., Chicago, Ill.—gasoline
The Buffalo Hoist & Derrick Co., Buffalo, N. Y.
Busch-Sulzer Bros. Diesel Engine Co., St. Louis, Mo.
Charter Gas Engine Co., Sterling, Ill.—gasoline, gas, kerosene and oil
Chicago Pneumatic Tool Co., New York, N. Y.—gas, oil and steam
Climax Engineering Co., Clinton, Ia.—gasoline and kerosene for steam shovels, cranes, etc.—see pages 5-6
Clyde Iron Works, Duluth, Minn.—gasoline, steam and belt hoisting
The Cook Motor Co., Delaware, O.—gas, gasoline, and kerosene
De La Verne Engine Co., New York, N. Y.—diesel
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Ellicott Machine Corp., Baltimore, Md.
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Evinrude Motor Co., Milwaukee, Wis.—gasoline
Fairbanks, Morse & Co., Chicago, Ill.—gasoline and semi-diesel
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Ideal Engine Co., Lansing, Mich.—gas
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Kahlenberg Bros. Co., Two Rivers, Wis.—oil
Lansing Motor & Pump Co., Lansing, Mich.—hoisting
Lidgerwood Mfg. Co., Chicago, Ill.—steam, electric and gasoline
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Murray Iron Works Co., Burlington, Ia.—steam
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Novo Engine Co., Lansing, Mich.—gas
Orr & Sembower, Reading, Pa.—steam, electric and gasoline hoisting
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The Power Mfg. Co., Marion, O.—semi-diesel—see page 197
Saxe & Heald, Chicago, Ill.—steam
Schramm, Inc., West Chester, Pa.—gasoline
The T. L. Smith Co., Milwaukee, Wis.—gas
The St. Mary's Oil Engine Co., St. Charles, Mo.—diesel
H. N. Strait Mfg. Co., Kansas City, Mo.—gas
B. F. Sturtevant Co., Boston, Mass.—steam
Superior Iron Works, Superior, Wis.—steam
Universal Motor Co., Oshkosh, Wis.—gas
Universal Road Machinery Co., Kingston, N. Y.—see page 192

***If you like the service of this journal it won't harm to tell us. If there is something about ROCK PRODUCTS you do not like—it will do good to tell us. We will benefit and be better able to serve you.***

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The Wellman-Seaver-Morgan Co., Cleveland, O.—gasoline
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Schofield-Burkett Construction Co., Macon, Ga.—for stripping and loading
T. L. Smith Co., Milwaukee, Wis.
Thew Shovel Co., Lorain, O.

### EXPLOSIVES AND BLASTING SUPPLIES

Atlas Powder Co., Wilmington, Del.—see page 190
E. I. du Pont de Nemours & Co., Wilmington, Del.
General Explosives Co., Chicago, Ill.
The Giant Powder Co., Con., San Francisco, Calif.
The Grasselli Powder Co., Cleveland, O.—see page 161
Hercules Powder Co., Wilmington, Del.
Illinois Powder Mfg. Co., St. Louis, Mo.
Trojan Powder Co., Allentown, Pa.

### FANS

American Blower Co., Detroit, Mich.
Buckeye Blower Co., Columbus, O.
Buffalo Forge Co., Buffalo, N. Y.
The Champion Blower & Forge Co., Lancaster, Pa.
General Electric Co., Schenectady, N. Y.—see pages 34-35
The Jeffrey Mfg. Co., Columbus, O.—see pages 46-47
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.—see page 172
The Raymond Bros. Impact Pulverizer Co., Chicago, Ill.—exhaust—see pages 24-25
B. F. Sturtevant Co., Boston, Mass

### FASTENERS—(Belt)

The Bristol Co., Waterbury, Conn.
Crescent Belt Fastener Co., New York, N. Y.—see page 198
Flexible Steel Lacing Co., Chicago, Ill.

### FEEDERS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 14
The Automatic Furnace Co., Dayton, O.—coal
C. O. Bartlett & Snow Co., Cleveland, O.
Beach Mfg. Co., Charlotte, Mich.
Bonnot Co., Canton, O.
C. G. Buchanan Co., Inc., New York, N. Y.—see page 159
Chalmers and Williams, Inc., Chicago Heights, Ill.—see page 149
Dodge Mfg. Co., Mishawaka, Ind.—see page 162
Fuller-Lehigh Co., Fullerton, Pa.—see page 22
Good Roads Machinery Co., Inc., Kennett Square, Pa.—apron—see page 164
The Greenville Mfg. Co., Greenville, O.—automatic rotary
Gruendler Patent Crusher and Pulverizer Co., St. Louis, Mo.—stone
The Jeffrey Mfg. Co., Columbus, O.—see pages 46-47
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.—disc, plunger, pendulum, roll, pan—see page 172
Link-Belt Co., Chicago, Ill.—apron—see page 152 and back cover
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Maddox Foundry & Machine Co., Archer, Fla.
Robins Conveying Belt Co., New York, N. Y.—see page 156
Saxe & Heald, Chicago, Ill.—coal
F. L. Smidth & Co., New York, N. Y.—slurry, coal, cradle, dry, etc.—see page 195
Smith Engineering Works, Milwaukee, Wis.—see page 176
Southwestern Eng. Co., Los Angeles, Cal.
Steacy-Schmidt Mfg. Co., New York, N. Y.
The Stearns Conveyor Co., Cleveland, O.
Stephens-Adamson Mfg. Co., Aurora, Ill.—see page 150
W. Toepfer & Sons Co., Milwaukee, Wis.—see page 173
Traylor Engineering & Mfg. Co., Allentown, Pa.—see pages 44-45
The Webster Mfg. Co., Chicago, Ill.—see page 27
Weller Mfg. Co., Chicago, Ill.—see page 176
Williams Patent Crusher & Pulverizer Co., St. Louis, Mo.—automatic—see inside front cover
Worthington Pump & Mchy. Corp., New York, N. Y.—see pages 18-19

### FEED WATER HEATERS

The Brownell Co., Dayton, O.
The Houston, Stanwood & Gamble Co., Inc., Cincinnati, O.
Saxe & Heald, Chicago, Ill.
Southwestern Eng. Co., Los Angeles, Cal.
The Superheater Co., New York, N. Y.
Worthington Pump and Machinery Corp., New York, N. Y.—see pages 18-19

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### FEED WATER REGULATOR
Co-operative Utilities Co., Philadelphia, Pa.

### FILTER CLOTH
Filter Fabrics Co., Salt Lake City, Utah
Ludlow-Saylor Co., St. Louis, Mo.
Newark Wire Cloth Co., Newark, N. J.

### FILTRATION SYSTEMS—(For Oil)
S. F. Bowser & Co., Fort Wayne, Ind.

### FIRE APPARATUS
Federal Electric Co., Chicago, Ill.—alarms
Foamite Childs Corporation, Utica, N. Y.
Howe Fire Apparatus Co., Anderson, Ind.
International Motor Co., New York, N. Y.
Mine Safety Appliances Co., Pittsburgh, Pa.
Safety First Supply Co., Pittsburgh, Pa.

### FORGES
Armstrong Mfg. Co., Waterloo, Ia.—see page 180
C. C. Bradley and Sons, Syracuse, N. Y.
Buffalo Forge Co., Buffalo, N. Y.
The Champion Blower & Forge Co., Lancaster, Pa.
Denver Rock Drill Mfg. Co., Denver, Colo.—oil, for drill steel—see page 60
Hauck Manufacturing Co., Brooklyn, N. Y.
The Hill Clutch Co., Cleveland, O.—see page 195
Ingersoll-Rand Co., New York, N. Y.
Manning, Maxwell & Moore, Inc., New York, N. Y.
Newhall Chain Forge & Iron Co., New York, N. Y.
Philadelphia Steel & Iron Co., Philadelphia, Pa.
W. S. Tyler Co., Cleveland, O.—see page 163

### FIRE BRICK
Ashland Fire Brick Co., Ashland, Ky.
Basic Products Co., St. Louis, Mo.
Betson Plastic Fire Brick Co., Rome, N. Y.
Chicago Fire Brick Co., Chicago, Ill.
Chicago Retort & Fire Brick Co., Chicago, Ill.
Eastern Clay Goods Co., Boston, Mass.
Foote Mineral Co., Inc., Philadelphia, Pa.
A. P. Green Fire Brick Co., Mexico, Mo.
Laclede-Christy Co., St. Louis, Mo.
Harbison-Walker Refractories Co., Pittsburgh, Pa.
Robinson Clay Product Co., New York, N. Y.
Thomas Moulding Brick Co., Chicago, Ill.
Walsh Fire Clay Products Co., St. Louis, Mo.

### FROGS
Central Frog & Switch Co., Cincinnati, O.
Cincinnati Frog & Switch Co., Cincinnati, O.
Hadfield-Penfield Steel Co., Bucyrus, O.—see page 171
Weir Frog & Switch Co., Cincinnati, O.

### FUEL OIL SYSTEMS
Flinn & Freffein Co., Chicago, Ill.
Gilbert & Barker Mfg. Co., Springfield, Mass.
Grindle Fuel Equipment Co., Harvey, Ill.
Smokeless Oil Burner Co., Bucyrus, O.—see inside back cover

### FURNACES
Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 14
American Gas Furnace Co., Elizabeth, N. J.
The Automatic Furnace Co., Dayton, O.
Fuller-Lehigh Co., Fullerton, Pa.—see page 22
General Chemical Co., New York, N. Y.
General Electric Co., Schenectady, N. Y.—see pages 34-35
Gilbert & Barker Mfg. Co., Springfield, Mass.
Glamorgan Pipe & Foundry Co., Lynchburg, Va.
Ingersoll-Rand Co., New York, N. Y.
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.—see page 172
Manning, Maxwell & Moore, Inc., New York, N. Y.
Mine & Smelter Supply Co., Denver, Colo—see page 59
Pacific Foundry Co., San Francisco, Calif.
Reeves Bros. Co., Alliance, O.—see page 38
Saxe & Heald, Chicago, Ill.
Sullivan Machinery Co., Chicago, Ill.—see page 179
Traylor Engineering & Mfg. Co., Allentown, Pa.—see pages 44-45
Worthington Pump and Machinery Corp., New York, N. Y.—see pages 18-19

### FURNACES—(Laboratory)
E. H. Sargent & Co., Chicago, Ill.

### FUSES—(Blasting)
Atlas Powder Co., Wilmington, Del.—see page 190
E. I. du Pont de Nemours & Co., Wilmington, Del.
Ensign-Bickford Co., Simsbury, Conn.—Cordeau-Bickford detonating—see page 160
The Giant Powder Co., Cons., San Francisco, Calif.
The Grasselli Powder Co., Cleveland, Ohio—see page 161
Hercules Powder Co., Wilmington, Del.
Illinois Powder Mfg. Co., St. Louis, Mo.
Trojan Powder Co., Allentown, Pa.

### FUSES—(Electrical)
Bussmann Mfg. Co., St. Louis, Mo.
Chicago Fuse Mfg. Co., Chicago, Ill.
Colonial Supply Co., Pittsburgh, Pa.
Economy Fuse & Mfg. Co., Chicago, Ill.
Federal Electric Co., Chicago, Ill.
General Electric Co., Schenectady, N. Y.—see pages 34-35
Westinghouse Electric and Mfg. Co., E. Pittsburgh, Pa.—see pages 36-37

### FUSES—(Renewable)
Economy Fuse Mfg. Co., Chicago, Ill.

### GASKETS
The Booth Felt Co., Inc., Chicago, Ill.
Colonial Supply Co., Pittsburgh, Pa.
Crane Co., Chicago, Ill.
Jenkins Bros., New York, N. Y.
Johns-Manville, Inc., New York, N. Y.—asbestos
McCord Mfg. Co., Inc., Detroit, Mich.
New York Belting & Packing Co., New York—see page 168
Quaker City Rubber Co., Philadelphia, Pa.—see page 186

*It was Roosevelt who said that every man owed some time to the development of the industry of which he was devoted. Many producers subscribe for ROCK PRODUCTS for their superintendents and suggest to their contemporaries that ROCK PRODUCTS is the journal they should read.*

### GATES—(Bin)
Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 14
Austin Mfg. Co., Chicago, Ill.—see page 177
Earle C. Bacon, Inc., New York, N. Y.
The C. O. Bartlett and Snow Co., Cleveland, O.
Beaumont Mfg. Co., Philadelphia, Pa.
Brown Hoisting Machinery Co., Cleveland, O.—see page 1
The C. S. Card Iron Works Co., Denver, Colo.
Chalmers & Williams, Chicago Heights, Ill.—see page 149
Fuller-Lehigh Co., Fullerton, Pa.—see page 22
Good Roads Machinery Co., Inc., Kennett Square, Pa.—chutes—see page 164
Greenville Mfg. Co., Greenville, O.
C. W. Hunt & Co., Inc., W. New Brighton, N. Y.
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.—see page 172
Lakewood Eng. Co., Cleveland, O.
Link-Belt Co., Chicago, Ill.—see page 152 and back cover
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Mine & Smelter Supply Co., Denver, Colo.—see page 59
Reeves Bros. Co., Alliance, O.—see page 38
Robins Conveying Belt Co., New York, N. Y.—see page 156
Rogers Foundry & Machine Co., Joplin, Mo.
James B. Seaverns, Chicago, Ill.—see page 196
T. L. Smith Co., Milwaukee, Wis.
Smith Engineering Works, Milwaukee, Wis.—see page 176
Steacy-Schmidt Mfg. Co., New York, N. Y.
Sturtevant Mill Co., Boston, Mass.—see page 182
W. Toepfer & Sons Co., Milwaukee, Wis.—see page 173
Traylor Engineering & Mfg. Co., Allentown, Pa.—see pages 44-45
Webster Mfg. Co., Chicago, Ill.—see page 27
Weller Mfg. Co., Chicago, Ill.—see page 176
Worthington Pump & Machinery Corp., New York, N. Y.—see pages 18-19

### GAS ENGINES—See Engines
### GAS PRODUCERS
The Chapman Engineering Co., Mt. Vernon, O.
Duff Patents Co., Inc., Pittsburgh, Pa.
Flinn & Freffein Co., Chicago, Ill.
McGann Manufacturing Co., Inc., York, Pa.—see page 15
Morgan Construction Co., Worcester, Mass.—see page 191
The Otto Engine Works, Philadelphia, Pa.
Wellman-Seaver-Morgan Co., Cleveland, O.
R. D. Wood & Co., Philadelphia, Pa.—see page 188

### GAUGES
The Brown Instrument Co., Philadelphia, Pa.—draft
Foxboro Co., Inc., Foxboro, Mass.
General Electric Co., Schenectady, N. Y.—see pages 34-35

### GEARS
Albaugh-Dover Co., Chicago, Ill.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 14
B. & W. Oil-less Conveyor Co., Chicago, Ill.
Bethlehem Steel Co., Bethlehem, Pa.
H. W. Caldwell & Son Co., Chicago, Ill.—see page 153
W. E. Caldwell Co., Louisville, Ky.
Chain Belt Co., Milwaukee, Wis.—cast
The Cleveland Worm & Gear Co., Cleveland, O.—worm
De Laval Steam Turbine Co., Trenton, N. J.—double helical
Denver Engineering Works Co., Denver, Colo.
Dodge Sales and Engineering Co., Mishawaka, Ind.—conveyor and friction—see page 162
The Falk Corp., Milwaukee, Wis.—see page 157
Fawcus Machine Co., Pittsburgh, Pa.
Foote Bros. Gear & Mach. Co., Chicago, Ill.
Fuller-Lehigh Co., Fullerton, Pa.—see page 22
William Ganschow Co., Chicago, Ill.
General Electric Co., Schenectady, N. Y.—see pages 34-35
Hadfield-Penfield Steel Co., Bucyrus, O.—see page 171
Hesse-Ersted Iron Works, Portland, Ore.
Hill Clutch Co., Cleveland, O.—see page 195
Inland Engineering Co., Chicago, Ill.
D. O. James Mfg. Co., Chicago, Ill.
The Jeffrey Mfg. Co., Columbus, O.—see pages 46-47
W. A. Jones Foundry & Machine Co., Chicago, Ill.
Link-Belt Co., Chicago, Ill.—see page 152 and back cover
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
The Medart Co., St. Louis, Mo.
Mine & Smelter Supply Co., Denver, Colo.—see page 59
Moore Steam Turbine Co., Wellsville, N. Y.
Morse Chain Co., Ithaca, N. Y.—silent chain, spring
W. F. Mosser & Son, Allentown, Pa.
Pettibone Mulliken Co., Chicago, Ill.
Philadelphia Gear Works, Philadelphia, Pa.
Niles-Bement-Pond Co., New York, N. Y.
R. D. Nuttall Co., Pittsburgh, Pa.
A. Plamondon Mfg. Co., Chicago, Ill.
The Poole Engineering & Machine Co., Baltimore, Md.
Reeves Bros. Co., Alliance, O.—see page 38
Robins Conveying Belt Co., New York, N. Y.—see page 156
Stroh Steel-Hardening Process Co., Pittsburgh, Pa.
Superior Iron Works Co., Superior, Wis.
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.—manganese steel—see front cover
Terry Steam Turbine Co., Hartford, Conn.
Tool Steel Gear & Pinion Co., Cincinnati, O.—spur, bevel and tooth.
Vulcan Iron Works, Wilkes-Barre, Pa.—see page 186
Webster Mfg. Co., Chicago Ill.—see page 27
Weller Mfg. Co., Chicago, Ill.—see page 176
Westinghouse Electric and Mfg. Co., East Pittsburgh, Pa.—see pages 36-37

### GENERATORS—ELECTRICAL
See Electric Motors

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### GLASS SAND EQUIPMENT
American Process Co., New York, N. Y.—see inside back cover
Kennedy-Van Saun Engineering & Machinery Co., New York, N. Y.—see page 172
Lewistown Foundry & Machine Co., Lewistown, Pa.—see page 189
Stevenson Co., Wellsville, O.

### GRATES
The Automatic Furnace Co., Dayton, O.—shaking and dumping
Brownell Co., Dayton, O.
Canton Grate Co., Canton, O.
Combustion Engineering Corp., New York, N. Y.
Gehret Bros., Inc., Bridgeport, Pa.
The Houston, Stanwood & Gamble Co., Inc., Cincinnati, O.
Kramer Bros. Foundry Co., Dayton, O.—shaking and dumping
Saxe & Heald, Chicago, Ill.
Steacy-Schmidt Mfg. Co., New York, N. Y.

### GREASE
(See Lubricants)

### GRIZZLIES
Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 14
C. S. Card Iron Works Co., Denver, Colo.
Chalmers & Williams, Chicago Heights, Ill.—see page 149
Gruendler Pat. Cr. & Pulv. Co., St. Louis, Mo.
Hendrick Mfg. Co., Carbondale, Pa.—see page 200
Link-Belt Co., Chicago, Ill.—see page 152 and back cover
Manganese Steel Forge Co., Philadelphia—see page 181
Mine & Smelter Supply Co., Denver, Colo.—see page 59
Robins Conveying Belt Co., New York, N. Y.—cataract—see page 156
Rogers Foundry & Machine Co., Joplin, Mo.
Smith Engineering Works, Milwaukee, Wis.—see page 176
W. Toepfer & Sons Co., Milwaukee, Wis.—see page 173
Traylor Engineering & Mfg. Co., Allentown, Pa.—see pages 44-45
The Webster Mfg. Co., Chicago, Ill.—see page 27
Weller Mfg. Co., Chicago, Ill.—see page 176
Western Wheeled Scraper Co., Aurora, Ill.—see page 167
Williams Pat. Cr. & Pulv. Co., St. Louis, Mo.—see inside front cover

### GUARDS—(Machinery)
Buffalo Wire Works Co., Buffalo, N. Y.

### GYPSUM AND GYPSUM PLASTER PLANTS
Butterworth & Lowe, Grand Rapids, Mich.—see page 193
J. B. Ehrsam & Sons Mfg. Co., Enterprise, Kan.
Richard K. Meade & Co., Baltimore, Md.—see page 196

### HAIR PICKERS
J. B. Ehrsam & Sons Mfg. Co., Enterprise, Kan.

### HANGERS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 14
H. W. Caldwell & Son Co., Chicago, Ill.—see page 153
Chain Belt Co., Milwaukee, Wis.
R. & J. Dick Co., Inc., Passaic, N. J.—shaft
Dodge Mfg. Corp., Mishawaka, Ind.—see page 162
Hill Clutch Co., Cleveland, O.—see page 195
W. A. Jones Foundry & Machine Co., Chicago, Ill.—shaft
Link-Belt Co., Chicago, Ill.—electric—see page 152 and back cover
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
The Medart Co., St. Louis, Mo.
The Webster Mfg. Co., Chicago, Ill.—see page 27
Weller Mfg. Co., Chicago, Ill.—see page 176

### HEATERS—Also See Blow Torches
General Electric Co., Schenectady, N. Y.—see pages 34-35
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.—see page 172

### HOISTS—(Steam, Gasoline and Electric)
Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 14
The American Cement Machine Co., Inc., Keokuk, Ia.
American Hoist & Derrick Co., St. Paul, Minn.—see page 197
Austin Manufacturing Co., Chicago, Ill.—see page 177
Austin Western Road Machinery Co., Chicago, Ill.—see page 177
Earle C. Bacon, Inc., New York, N. Y.
The C. O. Bartlett and Snow Co., Cleveland, O.
Beach Mfg. Co., Charlotte, Mich.—double-drum
R. H. Beaumont Co., Philadelphia, Pa.—skip
Bedford Foundry & Machine Co., Bedford, Ind.—power
The Brown Hoisting Machinery Co., Cleveland, O.—see page 1
Buffalo Hoist & Derrick Co., Buffalo, N. Y.
The Byers Machine Co., Ravenna, O.—steam, gasoline, electric and belt—see page 184
James H. Channon Mfg. Co., Chicago, Ill.
Chicago Pneumatic Tool Co., New York, N. Y.—air
Clyde Iron Works, Duluth, Minn.
Columbia Steel Tank Works, Kansas City, Mo.—truck
Conveyors Corp. of America, Chicago, Ill.
Denver Engineering Works Co., Denver, Colo.—electric
Denver Rock Drill Mfg. Co., Denver, Colo.—pneumatic—see page 60
Dobbie Foundry & Machine Co., Niagara Falls, N. Y.
English Tool & Supply Co., Kansas City, Mo.—see page 199
Erie Clutch & Pulley Co., Erie, Pa.

***A good many hundreds of dollars have been spent to bring this big Review and Directory Number to you. This directory feature alone will serve scores of buyers when they want the right name at the right time. Place this number where it never will get out of your sight and do not fail to say "ROCK PRODUCTS" when writing the manufacturers.***

The Erie Hoist Co., Erie, Pa.—all kinds
Exeter Machine Works, Inc., West Pittston, Pa.
Fairbanks, Morse & Co., Chicago, Ill.
S. Flory Mfg. Co., Bangor, Pa.—see page 180
General Electric Co., Schenectady, N. Y.—see pages 34-35
The Godfrey Conveyor Co., Elkhart, Ind.
Good Roads Machinery Co., Kennett Square, Pa.—see page 164
L. P. Green, Chicago, Ill.
Gruendler Patent Crusher & Pulverizer Co., St. Louis, Mo.
Guarantee Construction Co., New York, N. Y.
The Geo. Haiss Mfg. Co., Inc., New York, N. Y.
The Hayward Co., New York, N. Y.
The Heil Co., Milwaukee, Wis.—truck
Joshua Hendy Iron Works, San Francisco, Calif.
C. W. Hunt & Co., Inc., W. New Brighton, N. Y.
Ideal Engine Co., Lansing, Mich.—gas
Ingersoll-Rand Co., New York, N. Y.—air
Jackson & Church Co., Saginaw, Mich.—see pages 40-41
Jeffrey Mfg. Co., Columbus, O.—skip—see pages 46-47
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.—see page 172
Lake Shore Engine Works, Marquette, Mich.
Lambert Hoisting Engine Co., Newark, N. J.
Lansing Motor & Pump Co., Lansing, Mich.—drum, dragline
Lidgerwood Mfg. Co., New York, N. Y.
Link-Belt Co., Chicago, Ill.—electric—see page 152 and back cover
McLanahan-Stone Machine Co., Hollidaysburg, Pa.—friction and electric—see page 192
The Marion Steam Shovel Co., Marion, O.—see pages 8-9
Maris Brothers, Inc., Philadelphia, Pa.—electric
Link-Belt Meese & Gottfried Co., San Francisco, Calif.—plain, geared and friction
Mining Machine Co., Mountville, Pa.—motor driven
Motorbloc Corporation, Summerdale, Philadelphia, Pa.—chain driven
J. S. Mundy Hoisting Engine Co., Newark, N. J.
National Hoisting Engine Co., Harrison, N. J.
Northern Engineering Works, Detroit, Mich.—monorail, grab bucket, electric and air
Novo Engine Co., Lansing, Mich.
O. K. Clutch & Machinery Co., Columbia, Pa.—drum, reversible, and non-reversible, gasoline, electric or belt drive
Orr & Sembower, Reading, Pa.
Ottumwa Box Car Loader Co., Ottumwa, Ia.—see page 187
Ottumwa Iron Works, Ottumwa, Ia.—electric and steam
Patten Mfg. Co., Chattanooga, Tenn.—gasoline, electric, belt
Pawling & Harnischfeger Co., Milwaukee, Wis.—see page 39
The Pneumelectric Corp., Syracuse, N. Y.
Jos. T. Ryerson & Son, Chicago, Ill.
Schramm, Inc., West Chester, Pa.—compressor
Smith Engineering Works, Milwaukee, Wis.—see page 176
Standard Steel Works, North Kansas City, Mo.—truck
Sullivan Machinery Co., Chicago, Ill.—air—see page 179
Thomas Elevator Co., Chicago, Ill.—band and cone friction—see page 169
Universal Hoist & Mfg. Co., Cedar Falls, Ia.
Vulcan Iron Works, Wilkes-Barre, Pa.—see page 186
Weller Mfg. Co., Chicago, Ill.—see page 176
Wellman-Seaver-Morgan Co., Cleveland, O.
Wood-Detroit Hydraulic Hoist Co., Detroit, Mich.
Wright Mfg. Co., Lisbon, O.—high speed

### HOISTS—(Air)
Curtis Pneumatic Machinery Co., St. Louis, Mo.—see page 43
Heil Co., Milwaukee, Wis.
Sullivan Machinery Co., Chicago, Ill.—see page 179

### HOISTS—(Hand)
Erie Hoist Co., Erie, Pa.

### HOOKS
The Columbus McKinnon Chain Co., Columbus, O.
Macwhyte Co., Kenosha, Wis.
Newhall Chain Forge & Iron Co., New York, N. Y.
United States Chain & Forging Co., Pittsburgh, Pa.
The Wellman-Seaver-Morgan Co., Cleveland, O.

### HOPPERS AND SPOUTS
Atlas Car & Mfg. Co., Cleveland, O.—see page 174
Atlas Engineering Co., Milwaukee, Wis.
Biehl Iron Works, Reading, Pa.
H. W. Caldwell & Son Co., Chicago, Ill.—see page 153
Dings Magnetic Separator Co., Milwaukee, Wis.—spouts—see page 151
The Galion Iron Works & Mfg. Co., Galion, O.
Gruendler Pat. Crusher & Pulv. Co., St. Louis, Mo.
The Greenville Mfg. Co., Greenville, O.
Hendrick Mfg. Co., Carbondale, Pa.—see page 200
Jackson & Church Co., Saginaw, Mich.—see pages 40-41
Link-Belt Co., Chicago, Ill.—see page 152 and back cover
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Littleford Bros., Cincinnati, O.—hoppers.
Magnetic Mfg. Co., Milwaukee, Wis.—magnetic spouts
The Reeves Bros. Co., Alliance, O.—hoppers—see page 38
Rogers Foundry & Machine Co., Joplin, Mo.
James B. Seaverns, Chicago, Ill.—steel—see page 196
Steacy-Schmidt Mfg. Co., New York, N. Y.
Sturtevant Mill Co., Boston, Mass.—see page 182

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The Union Engineering Co., Cleveland, O.
Webb City & Carterville Fndry. & Mach. Co., Webb City, Mo.—see page 192
The Youngstown Boiler & Tank Co., Youngstown, O.—cement screen

**HOSE—(Water, Steam, Pneumatic, Air Drill)**
The Alexander Milburn Co., Baltimore, Md.—welding
The American Metal Hose Co., Waterbury, Conn.—flexible metal
Badger Belt & Rubber Corp., Milwaukee, Wis.
Chicago Pneumatic Tool Co., New York, N. Y.
The Cincinnati Rubber Mfg. Co., Cincinnati, O.
The Cleveland Rock Drill Co., Cleveland, O.
Edson Mfg. Corp., Boston, Mass.
Empire Tire & Rubber Corp., Chicago, Ill.—see page 56
B. F. Goodrich Rubber Co., Akron, O.—all kinds
The Goodyear Tire & Rubber Co., Akron, O.
Hardsog Wonder Drill Co., Ottumwa, Ia.
Ingersoll-Rand Co, New York, N. Y.
The Manhattan Rubber Mfg. Co., Chicago, Ill.—all kinds
The McIlroy Belting & Hose Co., Hammond, Ind.
Mulconroy Co., Philadelphia, Pa., flexible metallic, all kinds
New York Belting & Packing Co., New York, N. Y.—see page 168
New York Rubber Co., New York, N. Y.
Quaker City Rubber Co., Philadelphia, Pa.—see page 186
The Republic Rubber Co., Youngstown, O.—all kinds
Robins Conveying Belt Co., New York, N. Y.—see page 156
Rossendale-Reddaway Belting & Hose Co., Newark, N. J.
W. H. Salisbury & Co., Inc., Chicago, Ill.
Schramm, Inc., West Chester, Pa.—air
United States Rubber Co., Akron, O.
Weller Mfg. Co., Chicago, Ill.—see page 176

**HOSE—(Rubber)**
Cincinnati Rubber Mfg. Co., Cincinnati, O.
Edson Mfg. Corp., Boston, Mass.
Empire Tire & Rubber Corp., Trenton, N. J.—see page 56
B. F. Goodrich Rubber Co., Akron, O.
Mulconroy Co., Philadelphia, Pa.
Quaker City Rubber Co., Philadelphia, Pa.—see page 186
Schramm, Inc., West Chester, Pa.
Steacy-Schmidt Mfg. Co., New York, N. Y.

**HOUSES—(Portable)**
Littleford Bros., Cincinnati, O.
Wisconsin Bridge & Iron Co., N. Milwaukee, Wis.

**HYDRATING EQUIPMENT**
Arnold & Weigel, Woodville, O.—see page 31
Atlas Car & Mfg. Co., Cleveland, O.—see page 174
Blaw-Knox Co., Pittsburgh, Pa.
Jackson & Church Co., Saginaw, Mich.—see page 40-41
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.—see page 172
The Kritzer Co., Chicago, Ill.—see page 194
McGann Mfg. Co., Inc., York, Pa.—see page 15
Richard K. Meade & Co., Baltimore, Md.—see page 196
H. Miscampbell Co., Duluth, Minn.—see page 23
Schaffer Eng. & Equipment Co., Pittsburgh, Pa.—see page 191
Steacy-Schmidt Mfg. Co., New York, N. Y.
W. Toepfer & Sons Co., Milwaukee, Wis.—see page 173

**HYGROMETERS—(Indicating and Recording)**
Brown Instrument Co., Philadelphia, Pa.

**INDICATING AND RECORDING INSTRUMENTS (Pyrometers)**
Bristol Co., Waterbury, Conn.
Brown Instrument Co., Philadelphia, Pa.
Cleveland Instrument Co., Cleveland, O.
Foxboro Co., Inc., Foxboro, Mass.
Leeds & Northrup Co., Philadelphia, Pa.
E. H. Sargent Co., Chicago, Ill.
Taylor Instrument Co., Rochester, N. Y.
Thwing Instrument Co., Philadelphia, Pa.
Wilson-Maulen Co., New York, N. Y.

**INSULATION—(Heat)**
Armstrong Cork Co., Pittsburgh, Pa.
Celite Products Co., Chicago, Ill.—cement kiln, boiler, lime kiln, high temperature cements—see page 154
Johns-Manville, Inc., New York, N. Y.

**KETTLES—(Calcining)**
Atlas Car & Mfg. Co., Cleveland, O.—see page 174
Butterworth & Lowe, Grand Rapids, Mich.—see page 193
J. B. Ehrsam & Sons Co., Enterprise Kan.
Hendrick Mfg. Co., Carbondale, Pa.—see page 200
The Reeves Bros. Co., Alliance, O.—see page 38
Standard Steel Works, North Kansas City, Mo.

**KILNS**
Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 14
American Process Co., New York, N. Y.—see inside back cover
Arnold & Weigel, Woodville, O.—shaft—see page 31
C. O. Bartlett & Snow Co., Cleveland, O.
Blaw-Knox Co., Pittsburgh, Pa.
The Bonnot Co., Canton, O.—rotary
L. R. Christie Co., Pittsburgh, Pa.—see page 48
The Denver Engineering Works Co., Denver, Colo.—rotary lime and cement
Duff Patents Co., Inc., Pittsburgh, Pa.—rotary and shaft

***Now distance is measured by time, not miles. Time is the all important factor. It is the most profitable thing you have to sell. It is the most costly thing you have to buy. This directory is to make time work for you in black figures instead of red. Use it! Wire when necessary. If you say ROCK PRODUCTS when writing manufacturers, that will save you more time.***

Glamorgan Pipe & Foundry Co., Lynchburg, Va.
Joshua Hendy Iron Works, San Francisco, Calif.
Hendrick Mfg. Co., Carbondale, Pa.—lime—see page 200
The Improved Equipment Co., New York, N. Y.—vertical type, Doherty-Eldred process
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.—see page 172
McGann Mfg. Co., Inc., York, Pa.—rotary and vertical—see page 15
Richard K. Meade & Co., Baltimore, Md.—see page 196
H. Miscampbell, Duluth, Minn.—see page 23
W. F. Mosser & Son, Allentown, Pa.—rotary
The Reeves Bros. Co., Alliance, O.—rotary, cement and lime—see page 38
Ruggles-Coles Engineering Co., New York, N. Y.
Schaffer Engineering & Equipment Co., Pittsburgh, Pa.—see page 191
F. L. Smidth & Co., New York, N. Y.—rotary—see page 195
Steacy-Schmidt Mfg. Co., New York, N. Y.—shaft
Stearns-Roger Mfg. Co., Denver, Colo.
Traylor Eng. & Mfg. Co., Allentown, Pa.—rotary—see page 44-45
Vulcan Iron Works, Wilkes-Barre, Pa.—see page 186
Weller Mfg. Co., Chicago, Ill.—see page 176
Worthington Pump & Machinery Corp., New York, N. Y.—see pages 18-19

**LABORATORY EQUIPMENT**
Braun Corp., Los Angeles, Calif.
Central Scientific Materials Co., Chicago, Ill.
Finer & Amend, New York, N. Y.
Mine & Smelter Supply Co., Denver, Colo.—see page 59
Riehle Testing Machine Co., Philadelphia, Pa.
E. H. Sargent & Co., Chicago, Ill.
Sturtevant Mill Co., Boston, Mass.—see page 182

**LACING—(Belt)**
Alexander Bros., Philadelphia, Pa.
Bristol Co., Waterbury, Conn.
Cleveland Belting & Machinery Co., Cleveland, O.
Crescent Belt Fastener Co., New York, N. Y.—see page 198
Druid Belting Co., Baltimore, Md.
Flexible Steel Lacing Co., Chicago, Ill.
Graton & Knight Mfg. Co., Worcester, Mass.
National Leather Belting Co., New York, N. Y.
J. E. Rhoads & Son, Philadelphia, Pa.

**LIGHTS—(Portable Acetylene)**
Carbic Mfg. Co., Duluth, Minn.

**LIME HANDLING EQUIPMENT**
J. R. Alsing Engineering Co., New York, N. Y.
Arnold & Weigel, Woodville, O.—see page 31
Chain Belt Co., Milwaukee, Wis.
Jeffrey Mfg. Co., Columbus, O.—see pages 46-47
Link-Belt Co., Chicago, Ill.—see page 152 and back cover
Webster Mfg. Co., Chicago, Ill.—see page 27
Weller Mfg. Co., Chicago, Ill.—see page 176

**LIME AND HYDRATING PLANTS**
Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 14
Arnold & Weigel, Woodville, O.—see page 31
Blue Diamond Materials Co., 5034 Grand Central Terminal, New York, N. Y.—A. P. McCallie, General Agent—see page 52
Fullerton Eng. Co., Fullerton, Pa.
Glamorgan Pipe & Foundry Co., Lynchburg, Va.
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.—see page 172
McGann Mfg. Co., Inc., York, Pa.—see page 15
Kritzer Co., Chicago, Ill.—see page 194
Richard K. Meade & Co., Baltimore, Md.—see page 196
H. Miscampbell, Duluth, Minn.—see page 23
Schaffer Engineering Co., Pittsburgh, Pa.—lime
Steacy-Schmidt Mfg. Co., New York, N. Y.

**LIME PACKERS**
S. Howes Co., Inc., Silver Creek, N. Y.—see page 196
Valve Bag Co. of America, Toledo, O.—see pages 54-55

**LINE SHAFT EQUIPMENT**
Dodge Mfg. Co., Mishawaka, Ind.—see page 162
Hill Clutch Co., Cleveland, O.—see page 195
Jones Fdy. & Machine Co., Chicago, Ill.

**LOADERS—UNLOADERS**
Atlas Engineering Co., Milwaukee, Wis.
Austin Machinery Corp., Toledo, O.—wagon
Barber-Greene Co., Aurora, Ill.
Bay City Dredge Works, Bay City, Mich.
Bay City Foundry & Machine Co., Bay City, Mich.
Brown Hoisting Machinery Co., Cleveland, O.—see page 1
Burch Plow Works, Crestline, O.
The Byers Machine Co., Ravenna, O.—car and wagon—see page 184
Chain Belt Co., Milwaukee, Wis.
Erie Steam Shovel Co., Erie, Pa.—see page 197
Fairmont Mining Machinery Co., Fairmont, W. Va.
The Galion Iron Works & Mfg. Co., Galion, O.
Gifford-Wood Co., Hudson, N. Y.
The Good Roads Machinery Co., Inc., Kennett Square, Pa.—see page 164
B. F. Goodrich Rubber Co., Akron, O.
The Geo. Haiss Mfg. Co., New York, N. Y.—all kinds
The Hamilton Mfg. Co., Columbus, O.
Hoar Shovel Co., Duluth, Minn.
Holly Pneumatic Systems, Inc., New York, N. Y.—pneumatic
Industrial Works, Bay City, Mich.—see page 185
The Jeffrey Mfg. Co., Columbus, O.—see page 46-47
Lake Superior Loader Co., Duluth, Minn.—underground

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Lee Trailer & Body Co., Chicago, Ill.
Link-Belt Co., Chicago, Ill.—all types—see page 152 and back cover
Manierre Engineering & Machinery Co., Milwaukee, Wis.
Marion Steam Shovel Co., Marion, O.—see page 8-9
McKinney-Harrington Co., North Chicago, Ill.
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Myers-Whaley Co., Knoxville, Tenn.
National Conveying Equipment Corp., Chicago, Ill.
Northern Conveyor & Mfg. Co., Milwaukee, Wis.
Orton & Steinbrenner Co., Chicago, Ill.—see page 49
Ottumwa Box Car Loader Co., Ottumwa, Ia.—box car—see page 187
Portable Machinery Co., Passaic, N. J.
Robins Conveying Belt Co., New York, N. Y.—see page 156
Schaffer Eng. & Equip. Co., Pittsburgh, Pa.—car loaders—see page 190
James B. Seaverns, Chicago, Ill.—see page 196
The Security Engineering Sales Co., Duluth, Minn.—log
T. L. Smith, Milwaukee, Wis.
Specialty Engineering Co., Philadelphia, Pa.—chain and bucket type
The Sunbury Mfg. Co., Sunbury, O.
Thew Shovel Co., Lorain, O.
Universal Road Machinery Co., Kingston, N. Y.—see page 192
Webster Mfg. Co., Chicago, Ill.—see page 27
Weller Mfg. Co., Chicago, Ill.—see page 176

### LOCOMOTIVES—(Compressed Air)

H. K. Porter Co., Pittsburgh, Pa.—see page 199

### LOCOMOTIVES—(Electric and Storage Battery)

American Locomotive Co., New York, N. Y.
Atlas Car & Mfg. Co., Cleveland, O.—see page 174
Baldwin Locomotive Works, Philadelphia, Pa.—see page 194
M. K. Frank, Pittsburgh, Pa.
General Electric Co., Schenectady, N. Y.—see pages 34-35
Goodman Mfg. Co., Chicago, Ill.
The Ironton Engine Co., Ironton, O.—see page 199
The Jeffrey Mfg. Co., Columbus, O.—see pages 46-47
Mancha Storage Battery Locomotive Co., St. Louis, Mo.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.—see pages 36-37
Geo. D. Whitcomb, Rochelle, Ill.

### LOCOMOTIVES—(Gasoline)

Adamson Motor Co., Birmingham, Ala.
American Locomotive Co., New York, N. Y.
The Atlas Car & Mfg. Co., Cleveland, O.—see page 174
Austin Machinery Corp., Toledo, O.
Baldwin Locomotive Works, Philadelphia, Pa.—see page 194
Brookville Truck & Tractor Co., Brookville, Pa.—see page 189
Davenport Locomotive Co., Davenport, Ia.—see page 58
Easton Car & Construction Co., Easton, Pa.—see page 183
The Fate-Root-Heath Co., Plymouth, O.—Plymouth—see page 16
Hadfield-Penfield Steel Co., Bucyrus, O.— see page 171
Industrial Equipment Co., Minster, O.
Koppel Industrial Car & Equipment Co., Koppel, Pa.—see inside back cover
Milwaukee Locomotive Mfg. Co., Milwaukee, Wis.—see page 57
Vulcan Iron Works, Wilkes-Barre, Pa.—see page 186
Geo. D. Whitcomb Co., Rochelle, Ill.

### LOCOMOTIVES—(Steam)

American Locomotive Co., New York, N. Y.
Baldwin Locomotive Works, Philadelphia, Pa.—see page 194
Birmingham Rail & Locomotive Co., Birmingham, Ala.
Davenport Locomotive Works, Davenport, Ia.—see page 58
Heisler Locomotive Works, Erie, Pa.
Lima Locomotive Works, Lima, O.
H. K. Porter Co., Pittsburgh, Pa.—see page 199
Vulcan Iron Works, Wilkes-Barre, Pa.—see page 186
Geo. D. Whitcomb Co., Rochelle, Ill.

### LOG WASHERS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 14
Dings Magnetic Separator Co., Milwaukee, Wis.—magnetic—see page 151
Joshua Hendy Iron Works, San Francisco, Calif.
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.—see page 172
Lewistown Fdy. & Machine Co., Lewistown, Pa.—see page 189
Magnetic Mfg. Co., Milwaukee, Wis.
McLanahan-Stone Machine Co., Hollidaysburg, Pa.—see page 192
Worthington Pump & Machinery Corp., New York, N. Y.—see page 18-19

### LUBRICANTS—(Oils and Greases)

Adam Cook's Sons Co., New York, N. Y.
Colonial Supply Co., Pittsburgh, Pa.
Fiske Bros. Refining Co., New York, N. Y.
Indian Refining Co., New York, N. Y.
Ironsides Co., Columbus, O.—wire rope and gear
Keystone Lubricating Co., Philadelphia, Pa.—see page 165

***ROCK PRODUCTS is the only journal in this industry whose circulation is paid and audited by the Audit Bureau of Circulations.***

A. Leschen & Sons Co., St. Louis, Mo.—wire rope—see page 29
Standard Oil Co., Chicago, Ill.
The Texas Company, New York, N. Y.
Vacuum Oil Co., New York, N. Y.

### LUBRICATING SYSTEMS

S. F. Bowser & Co., Inc., Ft. Wayne, Ind.—automatic
Gilbert & Barker Mfg. Co., Springfield, Mass.
Keystone Lubricating Co., Philadelphia, Pa.—see page 165
Ottumwa Box Car Loader Co., Ottumwa, Ia.—see page 187
Sanford-Day Iron Works, Knoxville, Tenn.
Wayne Oil Tank & Pump Co., Ft. Wayne, Ind.

### LUBRICATORS

S. F. Bowser & Co., Inc., Ft. Wayne, Ind.
Keystone Lubricating Co., Philadelphia, Pa.—see page 165

### MACHINE SHOP EQUIPMENT

The Black & Decker Mfg Co., Baltimore, Md.
Champion Blower & Forge Co., Lancaster, Pa.
Manning, Maxwell & Moore, Inc., New York, N. Y.
Moore & Moore, Reading, Pa.
Sullivan Machinery Co., Chicago, Ill.—see page 179

### MAGAZINES—(Storage, Portable)

Littleford Bros., Cincinnati, O.

### MAGNETIC DEVICES

**Pulleys, Separators, Drums, Concentrators, Safety Magnets, Magnetic Spouts, Special Magnets**

C. G. Buchanan Co., New York, N. Y.—see page 159
Cutler-Hammer Mfg. Co., Milwaukee, Wis.—clutches, pulleys, starters, etc.
Dings Magnetic Separator Co., Milwaukee, Wis.—see page 151
Electric Controller & Mfg. Co., Cleveland, O.
Magnetic Mfg. Co., Milwaukee, Wis.

### MANGANESE STEEL

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 14
American Manganese Steel Co., Chicago Heights, Ill.—see page 188
Bethlehem Steel Co., Bethlehem, Pa.
Hadfield-Penfield Steel Co., Bucyrus, O.—see page 171
Inland Engineering Co., Chicago, Ill.
Link-Belt Co., Chicago, Ill.—see page 152 and back cover
Managanese Steel Forge Co., Philadelphia, Pa.—see page 181
Mine & Smelter Supply Co., Denver, Colo.—see page 59
Moore & Moore, Reading, Pa.
Pettibone-Mulliken Co., Chicago, Ill.
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.—see front cover
Worthington Pump and Machinery Corp., New York, N. Y.—see pages 18-19

### MAN LIFTS

Bland Engineering Co., Minneapolis, Minn.

### MANILA ROPE

H. W. Caldwell & Son Co., Chicago, Ill.—see page 153
Colonial Supply Co., Pittsburgh, Pa.
Columbia Rope Co., Auburn, N. Y.
O. H. Davidson Equipment Co., Denver, Colo.
Filter Fabrics Co., Salt Lake City, Utah
C. W. Hunt & Co., Inc., W. New Brighton, N. Y.
Link-Belt Co., Chicago, Ill.—see page 152 and back cover
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Upson Walton Co., Cleveland, O.

### MASKS

Electric Arc Cutting & Welding Co., Newark, N. J.
Pulmosan Safety Equipment Co., Brooklyn N. Y.

### MEASURING DEVICES

C. W. Hunt Co., Inc., West New Brighton, N. Y.

### MECHANICAL RUBBER GOODS

Badger Belt & Rubber Corp., Milwaukee, Wis.
Cincinnati Rubber Mfg. Co., Cincinnati, O.
Empire Tire & Rubber Co. of N. J., Trenton, N. J.—see page 56
Goodrich Rubber Co., Akron, O.
Goodyear Rubber Co. Akron, O.
New York, Belting & Packing Co., New York, N. Y.—see page 168
Quaker City Rubber Co., Philadelphia, Pa.—see page 186

### METERS

Brown Instrument Co., Philadelphia, Pa.

### MILLS—(Grinding)

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 14
J. R. Alsing Engineering Co., New York, N. Y.—ball, tube, pebble
American Pulverizer Co., St. Louis, Mo.
Bonnot Co., Canton, O.
Bradley Pulverizer Co., Allentown, Pa.
Brainard Pulverizer Co., Chicago, Ill.
Braun Corp., Los Angeles, Calif.
Butterworth & Lowe, Grand Rapids, Mich.—Buhr stone—see page 193
Chalmers & Williams, Chicago Heights, Ill.—ball and tube—see page 149
Colorado Iron Works, Denver, Colo.
The Denver Engineering Works Co., Denver, Colo.—ball and tube
J. B. Ehrsam & Sons Mfg. Co., Enterprise, Kans.—gypsum
Fuller-Lehigh Co., Fullerton, Pa.—ball, tube—see page 22
Gruendler Pat. Crusher & Pulv. Co., St. Louis, Mo.
Hardinge Co., New York, N. Y.—ball, conical—see page 7
Jackson & Church Co., Saginaw, Mich.—see page
Joshua Hendy Iron Works, San Francisco, Calif. 40-41
Jeffrey Mfg. Co., Columbus, O.—see pages 46-47
K-B Pulverizer Co., Inc., New York, N. Y.—hammer—see page 199
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.—see page 172
Kent Mill Co., Brooklyn, N. Y.—see page 178
Mine & Smelter Supply Co., Denver, Colo.—see page 59
Munson Mill Machinery Co., Inc., Utica, N. Y.—Buhr stone—see page 193

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Raymond Bros. Impact Pulv. Co., Chicago, Ill.—see pages 24-25
Southwestern Eng. Co., Los Angeles, Calif.
F. L. Smidth & Co., New York, N .Y.—see page 195
Steacy-Schmidt Mfg Co., New York, N. Y.
Stearns-Roger Mfg. Co., Denver, Colo.
E. H. Stroud & Co., Chicago, Ill.
Sturtevant Mill Co., Boston, Mass.—see page 182
W. Toepfer & Sons Co., Milwaukee, Wis.—see page 173
Traylor Engineering & Mfg. Co., Allentown, Pa.—see pages 44-45
Worthington Pump & Machinery Co., New York, N. Y.—see pages 18-19
Williams Patent Crusher and Pulverizer Co., St. Louis, Mo.—see inside front cover

### MIXERS
The American Cement Machine Co., Inc., Keokuk, Ia.—concrete
Atlas Eng. Co., Milwaukee, Wis.
Beach Mfg. Co., Charlotte, Mich.
Blystone Mfg. Co., Cambridge Springs, Pa—concrete
Chain Belt Co., Milwaukee, Wis.—concrete
J. B. Ehrsam & Sons Mfg. Co., Enterprise, Kan.
Koehring Co., Milwaukee, Wis.—see pages 10-11
Lakewood Engineering Co., Cleveland, O.—concrete
Manning, Maxwell & Moore, Inc., New York, N. Y.
Orr & Sembower, Inc., Reading, Pa.
T. L. Smith Co., Milwaukee, Wis.—concrete
Sturtevant Mill Co., Boston, Mass.—see page 182
Union Engineering Co, Cleveland, O.—concrete

### MIXING PANS
Stevenson Co., Wellsville, O.

### MOLDS—(Catch Basin and Silo)
Wert Mfg. Co., Chicago, Ill.

### MORTAR COLORS
C. K. Williams & Co., Easton, Pa.—see page 196

### MORTAR MIXING PLANTS
Blue Diamond Materials Co., 5034 Grand Central Terminal, New York, N. Y.—A. P. McCallie, General Agent—see page 52

### MOTORS AND GENERATORS
(See Electric Motors, etc.)

### MOTOR TRUCKS
Acme Motor Truck Co., Cadillac, Mich.
American Steam Truck Co., Chicago, Ill.
O. Armleder Co., Cincinnati, O.
Autocar Co., Ardmore, Pa.
Clark Tructractor Co., Chicago, Ill.
Columbia Motor Truck Co., Pontiac, Mich.
Commercial Truck Co., Philadelphia, Pa.
Diamond T Motor Car Co., Chicago, Ill.
Federal Motor Truck Co., Detroit, Mich.
Ford Motor Co., Detroit, Mich.
Four-Wheel-Drive Auto Co., Clintonville, Wis.—3 T. with power dump body
The Garford Motor Truck Co., Lima, O.
General Motors Truck Co., Pontiac, Mich.
Gramm-Bernstein Motor Truck Co., Lima, O.
International Motor Co., New York, N. Y.
Lee Trailer & Body Co., Chicago, Ill.—trailers
Lewis-Hall Motors Corp., Detroit, Mich.
The Nash Motors Co., Kenosha, Wis.
The Packard Motor Car Co., Detroit, Mich.
Pierce Arrow Motor Car Co., Buffalo, N. Y.
Republic Truck Sales Corp., Alma, Mich.
Service Motors, Inc., Wabash, Ind.
Sterling Motor Truck Co., Milwaukee, Wis.
Titian Motor Truck Co., Milwaukee, Wis.
Traffic Motor Truck Co., St. Louis, Mo.
Traylor Eng. & Mfg. Co., Allentown, Pa.—see pages 44-45
The White Co., Cleveland, O.
Winthers Motors, Inc., Kenosha, Wis.
U. S. Motor Truck Co., Covington, Ky.

### NOZZLES
Knox Mfg. Co., Philadelphia, Pa.—see page 17

### OIL
(See Lubricants)

### OIL BURNERS
Aeroil Burner Co., Inc., Union Hill, N. J.
W. N. Best Furnace & Burner Corp., New York, N. Y
Gilbert & Barker Mfg Co., Springfield, Mass.
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.—see page 172
W. S. Ray Mfg. Co, San Francisco, Calif
Smokeless Oil Burner Co., Bucyrus, O.—see inside back cover

### OIL ENGINES
(See Engines)

### PACKINGS
The Booth Felt Co., Inc., Chicago, Ill.
The Cincinnati Rubber Mfg. Co., Cincinnati, O.
Colonial Supply Co., Pittsburgh, Pa.
Crane Co., Chicago, Ill.
Empire Tire & Rubber Corp., Chicago, Ill.—rubber—see page 56
B. F. Goodrich Rubber Co., Akron, O.—all kinds
The Goodyear Tire & Rubber Co., Inc., Akron, O.
The Graton & Knight Mfg. Co., Worcester, Mass.—leather
Greene, Tweed & Co., New York, N. Y.
Johns-Manville, Inc., New York, N. Y.—asbestos
The Manhattan Rubber Mfg. Co., Chicago, Ill.—rubber
Manning, Maxwell & Moore, Inc., New York, N. Y.
N. Y. Belting & Packing Co., New York, N. Y.—see page 168
New York Rubber Co., New York, N. Y.—all kinds
Quaker City Rubber Co., Philadelphia, Pa.—see page 186
The Republic Rubber Co., Youngstown, O.—sheet
W. H. Salisbury & Co., Inc., Chicago, Ill.
United States Rubber Co., New York, N. Y.

### PACKING MACHINERY
Bates Valve Bag Co., Chicago, Ill.
J. B. Ehrsam & Sons Co., Enterprise, Kans.
S. Howes Co., Inc., Silver Creek, N. Y.—see page 196
Modern Valve Bag Co., Trenton, N. J.
Valve Bag Co. of America, Toledo, O.—see pages 54-55
Western Valve Bag Co., Chicago, Ill.

### PACKING PLANTS
Bates Valve Bag Co., Chicago, Ill.
Bland Engineering Co., Minneapolis, Minn.
MacDonald Engineering Co., Chicago, Ill.

### PANS—(Grinding)
Bonnot Co., Canton, O.
Hadfield-Penfield Steel Co., Bucyrus, O.—see page 171
Jackson & Church Co., Saginaw, Mich.—see pages 40-41
Lewistown Foundry & Machine Co., Lewistown, Pa.—wet and dry—see page 189
The Stevenson Co., Wellsville, O.

### PANS—(Mixing)
Stevenson Co., Wellsville, O.

### PAPER—(For Lining Cars)
Cleveland-Akron Bag Co., Cleveland, O.—rosin sized sheeting and rag
W. A. Johns Paper Co., Chicago, Ill.—see page 181

### PAVERS
Chain Belt Co., Milwaukee, Wis.
Koehring Co., Milwaukee, Wis.—see pages 10-11

### PERFORATED METAL
Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 14
Chicago Perforating Co., Chicago, Ill.
Cross Engineering Co., Carbondale, Pa.—see page 158
Harrington & King Perforating Co., Chicago, Ill.—see page 194
Hendrick Mfg. Co., Carbondale, Pa.—see page 200
Johnston & Chapman Co., Chicago, Ill.
Link-Belt Co., Chicago, Ill.—see page 152 and back cover
Nortmann-Duffke Co., Milwaukee, Wis.
Pittsburgh Perforating Co., Pittsburgh, Pa.
Rogers Foundry & Machine Co., Joplin, Mo.
W. Toepfer & Sons Co., Milwaukee, Wis.—see page 173
United Iron Wks., Inc., Kansas City, Mo.—see page 13
Webb City & Carterville Foundry & Machine Works, Webb City, Mo.—see page 192
Webster Mfg. Co., Chicago, Ill.—see page 27
Weller Mfg. Co., Chicago, Ill.—see page 176

### PIGMENTS
The Metro-Nite Co., Milwaukee, Wis.

### PILE DRIVERS
The Browning Co., Cleveland, O.—see page 53
The Byers Machine Co., Ravenna, O.—see page 184
Industrial Works, Bay City, Mich.—see page 185
Lidgerwood Mfg. Co., New York, N. Y.
J. S. Mundy Hoisting Engine Co., Newark, N. J.
Pawling & Harnischfeger Co., Milwaukee, Wis.—see page 39

### PINIONS (See Gears)

### PIPE
American Car & Foundry Co., Chicago, Ill.
American Rolling Mill Co., Middleton, O.—Armco ingot—special analysis steel dredge—see page 175
American Spiral Pipe Works, Chicago, Ill.—spiral riveted
The Biggs Boiler Works Co., Akron, O.—steel riveted
Blaw-Knox Co., Pittsburgh, Pa.
A. M. Byers Co., Pittsburgh, Pa.
Colonial Supply Co., Chicago, Ill.
Continental Pipe Mfg. Co., Seattle, Wash.—wood
Crane Co., Chicago, Ill.
L. B. Foster Co., Inc., Pittsburgh, Pa.
Glamorgan Pipe & Foundry Co., Lynchburg, Va.—cast iron
Hendrick Mfg. Co., Carbondale, Pa.—see page 200
Joshua Hendy Iron Works, San Francisco, Calif.
The Petroleum Iron Works Co. of Ohio, Sharon, Pa.
Reeves Bros. Co., Alliance, O.—see page 38
Traylor Engineering & Mfg. Co., Allentown, Pa.—see pages 44-45
United Lead Co., New York, N. Y.
Weller Mfg. Co., Chicago, Ill.—see page 176
R. D. Wood & Co., Philadelphia, Pa.—see page 188

### PIPE SLEEVES
See Dredge Sleeves

### PLASTER MACHINERY
Butterworth & Lowe, Grand Rapids, Mich.—see page 193
J. B. Ehrsam & Sons Mfg. Co., Enterprise, Kan.
Union Engineering Co., Cleveland, O.

### PLATES (Steel)
Bethlehem Steel Co., Bethlehem, Pa.
Biehl Iron Works, Inc., Reading, Pa.
Blaw-Knox Co., Pittsburgh, Pa.
Central Frog & Switch Co., Cincinnati, O.
Chicago Bridge & Iron Co., Chicago, Ill.
Duff Patents Co., Inc., Pittsburgh, Pa.
L. B. Foster Co., Pittsburgh, Pa.—tie
Fuller-Lehigh Co., Fullerton, Pa.—all kinds—see page 22
Littleford Bros., Cincinnati, O.
Manganese Steel Forge Co., Philadelphia, Pa.—see page 181
The Reeves Bros. Co., Alliance, O.—see page 38
Steacy-Schmidt Mfg. Co., New York, N. Y.
Sturtevant Mill Co., Boston, Mass.—see page 182
Traylor Engineering & Mfg. Co., Allentown, Pa.—see pages 44-45
Webster Mfg. Co., Chicago, Ill.—see page 27

### PORTABLE CONVEYORS
Atlas Engineering Co., Milwaukee, Wis.
Barber-Greene Co., Aurora, Ill.
Goldfrey Conveyor Co., Elkhart, Ind.
Gruendler Pat. Crusher & Pulv. Co., St. Louis, Mo.
Holly Pneumatic Systems, Inc., New York, N. Y.
Iowa Mfg. Co., Cedar Rapids, Iowa
Jeffrey Mfg. Co., Coumbus, O.—see pages 46-47
Link-Belt Co., Chicago, Ill.—see page 152 and back cover
Ottumwa Box Car Loader Co., Ottumwa, Iowa—see page 187
Portable Machinery Co., Passaic, N. J.
Robins Conveying Belt Co., New York, N. Y.—see page 156
Specialty Engineering Co., Philadelphia, Pa.
Standard Conveyor Co., N. St. Paul, Minn.

### POWER LINE RACK (Portable)
France Fdry. & Mach. Co., Toledo, O.

### POWER SHOVELS
Brown Hoisting Machinery Co., Cleveland, O.—see page 1
Browning Co., Cleveland, O.—see page 53
Bucyrus Co., So. Milwaukee, Wis.—see page 20
Erie Steam Shovel Co., Erie, Pa.—see page 197
Koehring Co., Milwaukee, Wis.—see pages 10-11
Marion Steam Shovel Co., Marion, O.—see pages 8-9

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McMyler-Interstate Co., Cleveland, O.—see page 12
Northwest Eng. Co., Chicago, Ill.—see pages 3-4
Orton & Steinbrenner Co., Chicago, Ill.—see page 49
Osgood Co., Marion, O.—see page 185
Ruston & Hornsby, Ltd., Lincoln, England
Thew Shovel Co., Lorain, O.

### PRECIPITATION EQUIPMENT (Electrical)
General Electric Co., Schenectady, N. Y.—see pages 34-35
Western Precipitation Co., Los Angeles, Calif.

### PRESSURE BLOWERS
J. R. Alsing Engineering Co., Inc., New York, N. Y.

### PULLEYS
C. G. Buchanan, Inc., New York, N. Y.—see page 159
H. W. Caldwell & Son Co., Chicago, Ill.—see page 153
W. E. Caldwell Co., Louisville, Ky.—friction clutch
R. & J. Dick Co., Inc., Passaic, N. J.—steel split
Dodge Mfg. Corp., Mishawaka, Ind.—see page 162
Hesse-Ersted Iron Works, Portland, Ore.
The Hill Clutch Co., Chicago, Ill.—see page 195
W. A. Jones Fdry. & Machine Co., Chicago, Ill.—friction clutch
Link-Belt Co., Chicago, Ill.—see page 152 and back cover
Manning, Maxwell & Moore, Inc., New York, N. Y.
The Medart Co., St. Louis, Mo.
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Munson Mill Machinery Co., Utica, N. Y.—see page 193
O. K. Clutch & Machinery Co., Columbia, Pa.
Philip Pressed Steel Pulley Works, Philadelphia, Pa.
Plamondon Mfg. Co., Chicago, Ill.
Webster Mfg. Co., Chicago, Ill.—see page 27
Weller Mfg. Co., Chicago, Ill.—see page 176

### PULLEYS—(Magnetic)
Dings Magnetic Separator Co., Milwaukee, Wis.—see page 151
Magnetic Mfg. Co., Milwaukee, Wis.

### PULVERATORS
J. R. Alsing Eng. Co., Inc., New York, N. Y.

### PULVERIZED COAL SYSTEMS
Aero Pulverizer Co., New York, N. Y.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 14
American Pulverizer Co., St. Louis, Mo.
The Bonnot Co., Canton, O.
L. R. Christie Co., Pittsburgh, Pa.—see page 48
Combustion Engineering Corp., New York, N. Y.
Erie City Iron Works, Erie, Pa.
Fuller-Lehigh Co., Fullerton, Pa.—see page 22
Grindle Fuel Equipment Co., Harvey, Ill.
Hardinge Co., New York, N. Y.—see page 7
K-B Pulverizer Co., Inc., New York, N. Y.—see page 199
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.—see page 172
Mine & Smelter Supply Co., Denver, Colo.—see page 59
Raymond Bros. Impact Pulv. Co., Chicago, Ill.—see pages 24-25
Richardson Scale Co., Passaic, N. J.—see page 188
Ruggles-Coles Engineering Co., New York, N. Y.
F. L. Smidth & Co., New York, N. Y.—see page 195
E. H. Stroud & Co., Chicago, Ill.
Sturtevant Mill Co., Boston, Mass.—see page 182
Weller Mfg. Co., Chicago, Ill.—see page 176
The Youngstown Boiler & Tank Co., Youngstown, O.

### PULVERIZERS
Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 14
J. R. Alsing Engineering Co., New York, N. Y.
American Pulverizer Co., St. Louis, Mo.
The C. O. Bartlett & Snow Co., Cleveland, O.
Bethlehem Steel Co., Bethlehem, Pa.—steel dredging
The Bonnot Co., Canton, O.
Bradley Pulverizer Co., Allentown, Pa.
Brainard Pulverizer Co., Chicago, Ill.
Dixie Machinery Mfg. Co., St. Louis, Mo.
Fuller-Lehigh Co., Fullerton, Pa.—see page 22
Gruendler Pat. Crusher & Pulv. Co., St. Louis, Mo.—ring roll
Hardinge & Co., New York, N. Y.—see page 7
Alfred Herbert, Ltd., Coventry, England—coal
Jackson & Church Co., Saginaw, Mich.—see pages 40-41
The Jeffrey Mfg. Co., Columbus, O.—see pages 46-47
K-B Pulverizer Co., New York, N. Y.—"Pulverburner," all kinds, see page 199
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.—roll hammer, ring roll, combination ball tube mills, ball mills, air-swept tube mills for coal, rock or clinker—see page 172
Kent Mill Co., Brooklyn, N. Y.—see page 178
Link-Belt Co., Chicago, Ill.—see page 152 and back cover
Mine & Smelter Supply Co., Denver, Colo.—see page 59
Munson Mill Machinery Co., Utica, N. Y.—see page 193
New Holland Machine Co., New Holland, Pa.—see page 196
Pennsylvania Crusher Co., Philadelphia, Pa.—see page 26
Raymond Bros. Impact Pulv. Co., Chicago, Ill.—see pages 24-25
Stearns-Roger Mfg. Co., Denver, Colo.
E. H. Stroud and Co., Chicago, Ill.
Sturtevant Mill Co., Boston, Mass.—see page 182
Traylor Engineering & Mfg. Co., Allentown, Pa.—see pages 44-45
Universal Crusher Co., Cedar Rapids, Iowa—see page 224
Universal Road Machinery Co., Kingston, N. Y.—see page 192
Williams Patent Crusher & Pulv. Co., St. Louis, Mo.—see inside front cover
Worthington Pump & Machinery Corp., New York, N. Y.—see pages 18-19

### PUMPS
Advance Pump & Compressor Co., Battle Creek, Mich.—centrifugal, power and steam
Aldrich Pump Co., Allentown, Pa.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.—air, slurry and centrifugal, see page 14
American Air Compressor Works, Brooklyn, N. Y.—vacuum
American Manganese Steel Co., Chicago Heights, Ill.—dredging, sand and gravel, see page 190
American Steam Pump Co., Battle Creek, Mich.
The American Well Works, Aurora, Ill.—centrifugal, etc.
Aurora Pump & Mfg. Co., Aurora, Ill.—deep well and turbine
Beach Mfg. Co., Charlotte, Mich.
W. H. K. Bennett, Mechanical Eng., Chicago, Ill.
Buffalo Forge Co., Buffalo, N. Y.
Buffalo Steam Pump Co., Buffalo, N. Y.
Chicago Pneumatic Tool Co., Mansfield, O.
Colorado Iron Wks., Denver, Colo.
O. H. Davidson Equipment Co., Denver, Colo.
De Laval Steam Turbine Co., Trenton, N. J.—centrifugal
Edson Mfg. Corporation, Boston, Mass.—diaphragm
Ellicott Machine Corp., Baltimore, Md.—dredging
The Emerson Pump & Valve Co., Alexandria, Va.—steam—see page 198
Erie Pump & Engine Works, Medina, N. Y.—centrifugal dredging
Evinrude Motor Co., Milwaukee, Wis.—centrifugal, high pressure, 1½-2 inch
Exeter Machine Works, Inc., W. Pittston, Pa.
Fairbanks, Morse & Co., Chicago, Ill.—centrifugal, piston and plunger
Fairmont Mining Machinery Co., Fairmont, W. Va.
Gilbert & Barker Mfg. Co., Springfield, Mass.—gas and oil
Glamorgan Pipe & Foundry Co., Lynchburg, Va.—centrifugal
Groch Centrifugal Floatation Co., El Paso, Texas
Hadfield-Penfield Steel Co., Bucyrus, O.—see page 171
Ingersoll-Rand Co., New York, N. Y.—centrifugal and direct-acting
Jackson Byron Iron Works, Inc., San Francisco, Calif.
Kansas City Hay Press & Tractor Co., Kansas City, Mo.—sand and dredging—see page 195
Krogh Pump & Machinery Co., San Francisco, Calif.—centrifugal sand
Lansing Motor & Pump Co., Inc., Lansing, Mich.
Link-Belt Meese & Gottfried Co., San Francisco, Calif.—centrifugal
Mine and Smelter Supply Co., Denver, Colo.—see page 59
Morris Machine Co., Baldwinsville, N. Y.—see page 43
F. E. Myers & Bros. Co., Ashland, O.—all kinds
The Norbon Engineering Co., Da by, Pa.—dredge
Novo Engine Co., Lansing, Mich.—centrifugal, diagraph, deep-well
Nye Steam Pump & Mach. Corp., Chicago, Ill.
Pennsylvania Pump & Compressor Co., Easton, Pa.—see page 196
Pneumelectric Corp., Syracuse, N. Y.
Pulsometer Steam Pump Co., New York, N. Y.—steam
Schramm, Inc., West Chester, Pa.—compressor
F. L. Smidth & Co., New York, N. Y.—slurry—see page 195
Smokeless Oil Burner Co., Bucyrus, O.—see inside back cover
Sullivan Machinery Co., Chicago, Ill.—see page 179
The Superheater Co., New York, N. Y.
Swaby Mfg. Co., Chicago, Ill.—centrifugal, others
Swintek Traveling Suction Screen Nozzle Co., Eddyville, Ia.
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.—centrifugal sand—see front cover
Traylor Engineering & Mfg. Co., Allentown, Pa.—see pages 44 and 45
United Iron Wks., Inc., Kansas City, Mo.—see page 13
United Lead Co., New York, N. Y.
Webb City & Carterville Fdry. & Machine Works, Webb City, Mo.—centrifugal—see page 192
Weinman Pump Co., Columbus, O.—centrifugal
Westco-Chippewa Pump Co., Davenport, Ia.
A. R. Wilfley & Sons, Denver, Colo.—see page 28
Worthington Pump & Mach. Corp., New York, N. Y.—power, centrifugal, steam and electric—see pages 18 and 19

### PYROMETERS—THERMOMETERS—TACHOMETERS
#### Indicating and Recording
Bristol Co., Waterbury, Conn.
The Brown Instrument Co., Philadelphia, Pa.
Cleveland Instrument Co., Cleveland, O.
Foxboro Co., Inc., Foxboro, Mass.
The Leeds & Northrup Co., Philadelphia, Pa.
Mine & Smelter Supply Co., Denver—see page 59
Taylor Instrument Co., Rochester, N. Y.
Thwing Instrument Co., Philadelphia, Pa.
Wilson-Maculen Co., New York, N. Y.

### RAIL-LAYING EQUIPMENT
Aldon Co., Chicago, Ill.

### RAILWAY EQUIPMENT
Atlas Ry. Supply Co., Chicago, Ill.
Western Wheeled Scraper Co., Aurora, Ill.—see page 167

### RECEIVERS—Air
The Brownell Co., Dayton, O.
The Bury Compressor Co., Erie, Pa.
Chicago Pneumatic Tool Co., New York, N. Y.
Curtis Pneumatic Mchy. Co., St. Louis, Mo.—see page 43
Holly Pneumatic Systems, Inc., New York, N. Y.
Ingersoll-Rand Co., New York, N. Y.
Reeves Bros., Alliance, O.—see page 38
Worthington Pump and Machinery Corp., New York, N. Y.—see pages 18 and 19

### REDUCERS
Hill Clutch Co., Cleveland, O.—see page 195

### REFRACTORIES
#### (See Fire Brick)
Adams & Jewell, Rome, N. Y.
Betson Plastic Fire Brick Co., Inc., Rome, N. Y.
Celite Products Co., Chicago, Ill.—see page 154
Steacy-Schmidt Mfg. Co., New York, N. Y.
Wahl Refractory Products Co., Freemont, O.

### RELAYING RAILS
Atlas Car & Mfg. Co., Cleveland, O.—see page 174
Central Frog & Switch Co., Cincinnati, O.
L. B. Foster Co., Inc., Pittsburgh, Pa.
M. K. Frank, Pittsburgh, Pa.
Hyman-Michaels Co., Chicago, Ill.—see page 193
Jos. T. Ryerson & Son, Inc., Chicago, Ill.

### RIMS—Traction
Foley Traction Rim Co., Minneapolis, Minn.

### ROAD MACHINERY—Rollers, Graders, Spreaders, Planers and Plows
Acme Road Mchy. Co., Frankfort, N. Y.—see page 192
Austin Manufacturing Co., Chicago, Ill.—see page 177
The Austin-Western Road Machinery Co., Chicago, Ill.—see page 177

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The Burch Plow Works Co., Crestline, O.
The Galion Iron Works & Mfg. Co., Galion, O.
Good Roads Machinery Co., Kennett Square, Pa. —see page 164
Ruggles-Coles Eng. Co., New York, N. Y.
Sanford-Day Iron Works, Knoxville, Tenn.
The Sunbury Mfg. Co., Sunbury, O.
Traylor Eng. & Mfg. Co., Allentown, Pa.—see pages 44 and 45
Universal Road Machinery Co., Kingston, N. Y. —see page 192
Western Wheeled Scraper Co., Aurora, Ill.—see page 167

### ROOFING AND SIDING MATERIAL

American Rolling Mill Co., Middletown, O.—Armco ingot iron—see page 175
Bethlehem Steel Co., Bethlehem, Pa.
Illinois Zinc Co., Chicago, Ill.
Johns-Manville, Inc., New York, N. Y.—asbestos
Mine & Smelter Supply Co., Denver, Colo.—see page 59
Newport Rolling Mill Co., Newport, Ky.
H. H. Robertson Co., Pittsburgh, Pa.
Jos. T. Ryerson & Son, Inc., Chicago, Ill.

### ROPE (Wire)

American Steel & Wire Co., Chicago, Ill.—see page 199
Beach Mfg. Co., Charlotte, Mich.
Broderick & Bascom Rope Co., St. Louis, Mo.
O. H. Davidson Equipment Co., Denver, Colo.
Dodge Sales & Eng. Co., Mishawaka, Ind.—see page 162
A. Leschen & Sons Rope Co., St. Louis, Mo.—see page 29
Link-Belt Co., Chicago, Ill.—see page 152 and back cover
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Macwhyte Co., Kenosha, Wis.
Geo. C. Moon Co., Garwood, N. J.
John A. Roebling's Sons Co., Trenton, N. J.
Upson-Walton Co., Cleveland, O.
Waterbury Co., New York, N. Y.
Wickwire Spencer Steel Corp., Worcester, Mass.
Williamsport Wire Rope Co., Chicago, Ill.

### SAFETY DEVICES (Goggles, Respirators, Etc.)

Chicago Eye Shield Co., Chicago, Ill.
Cleveland Railway Supply Co., Cleveland, O.
Colonial Supply Co., Pittsburgh, Pa.
Electric Arc Cutting & Welding Co., Newark, N. J.
Foamite-Childs Corp., Utica, N. Y.
Mine Safety Appliances Co., Pittsburgh, Pa.
Pulmosan Safety Equipment Co., Brooklyn, N. Y.
Safety First Supply Co., Pittsburgh, Pa.
Willson Goggles, Inc., Reading, Pa.

### SAND CONES

Allen Cone Co., El Paso, Texas
W. H. K. Bennett, M. E., Chicago, Ill.
Greenville Mfg. Co., Greenville, O.
Link-Belt Co., Chicago, Ill.—see page 152 and back cover
Mine & Smelter Supply Co., Denver, Colo.—see page 59
Smith Eng. Works, Milwaukee, Wis.—see page 176
Stephens-Adamson Mfg. Co., Aurora, Ill.—see page 150

### SAND GRINDING PANS

Lewistown Fdry. & Mach. Corp., Lewistown, Pa. —see page 189

### SAND TANKS

Allen Cone Co., El Paso, Texas
W. H. K. Bennett, M. E., Chicago, Ill.
Greenville Mfg. Co., Greenville, O.
Hendrick Mfg. Co., Carbondale, Pa.—see page 200
Link-Belt Co., Chicago, Ill.—see page 152 and back cover
Smith Engineering Works, Milwaukee, Wis.—see
[illegible] & Sons Co., Milwaukee, Wis.—see

### SCALES

[illegible]eighing Machine Co., New York,
Fai[illegible], Morse & Co., Chicago, Ill.—all types
C. W. Hunt & Co., W. New Brighton, N. Y.
Merrick Scale Mfg. Co., Passaic, N. J.—automatic, conveyor, weightometers—see page 199
Richardson Scale Co., Passaic, N. J.—automatic weighing and proportioning—see page 188
Schaffer Engineering & Equipment Co., Pittsburgh, Pa.—see page 190
Strait Scale Co., Kansas City, Mo.
Sturtevant Mill Co., Boston, Mass.—hopper and bagging—see page 182
Toledo Scale Co., Toledo, O.
Winslow Government Standard Scale Wks., Inc., Terre Haute, Ind.

### SCRAPERS

The Austin-Western Road Machinery Co., Chicago, Ill.—dump and wheeled—see page 177
Baker Mfg. Co., Springfield, Ill.
Beach Mfg. Co., Charlotte, Mich.
R. H. Beaumont Co., Philadelphia, Pa.—cable drag
Burch Plow Works, Crestline, O.
L. P. Green, Chicago, Ill.—drag
Link-Belt Co., Chicago, Ill.—see page 152 and back cover
Manning, Maxwell & Moore, Inc., New York, N. Y.
Sauerman Bros., Chicago, Ill.—drag and bottomless power—see page 183
Schofield-Burkett Construction Co., Macon, Ga.
The Sunbury Mfg. Co., Sunbury, O.
Western Wheeled Scraper Co., Aurora, Ill.—wheeled and drag—see page 167

### SCREEN NOZZLES

Swintek Traveling Suction Screen Co., Eddyville, Ia.—cutterhead

### SCREENS

Acme Road Mchy Co., Frankfort, N. Y.—see page 192
Allis-Chalmers Mfg. Co., Milwaukee, Wis.—revolving, shaking, conical—see page 14
Audubon Wire Cloth Co., Inc., Audubon, N. J.
Austin Manufacturing Co., Chicago, Ill.—see page 177
Austin-Western Road Machinery Co., Chicago, Ill. —see page 177
Earle C. Bacon, Inc., New York, N. Y.
The C. O. Bartlett & Snow Co., Cleveland, O.
Beach Mfg. Co., Charlotte, Mich.
C. G. Buchanan Co., Inc., New York, N. Y.—revolving—see page 159
Buffalo Wire Works, Buffalo, N. Y.
C. S. Card Iron Works Co., Denver, Colo.
Chain Belt Co., Milwaukee, Wis.—revolving, shaking, gravity
Chalmers & Williams, Chicago Heights, Ill.—pulsating, revolving—see page 149
The Cleveland Wire Cloth & Mfg. Co., Cleveland, O.—see page 166
Colorado Iron Works, Denver, Colo.—vibrating
Coyle & Roth, Minneapolis, Minn.
Cross Engineering Co., Carbondale, Pa.—see page 158
The Denver Engineering Works Co., Denver, Colo. —revolving
Dodge Mfg. Co., Mishawaka, Ind.—bar and trommel—see page 162
J. B. Ehrsam & Sons Mfg. Co., Enterprise, Kan.
Exeter Machine Works, Inc., West Pittston, Pa.
Fairmont Mining Machinery Co., Fairmont, W. Va.
Galion Iron Works, Galion, O.
Good Roads Machinery Co., Inc., Kennett Square, Pa.—revolving, shaking—see page 164
Greenville Mfg. Co., Greenville, O.—all types
Gruendler Pat. Crusher & Pulverizer Co., St. Louis, Mo.—revolving, vibrating
Hadfield-Penfield Steel Co., Bucyrus, O.—see page 171
The Geo. Haiss Mfg. Co., New York, N. Y.
Hardinge Co., New York, N. Y.—see page 7
Harrington & King Perforating Co., Chicago, Ill. —see page 194
Hendrick Mfg. Co., Carbondale, Pa.—revolving and shaking—see page 200
Joshua Hendy Iron Works, San Francisco, Calif.
Hesse-Ersted Iron Works, Portland, Ore.—revolving
Iowa Mfg. Co., Cedar Rapids, Ia.
The Jeffrey Mfg. Co., Columbus, O.—shaking—see pages 46-47
Johnston & Chapman Co., Chicago, Ill.—cylindrical and conical
Kennedy-Van Saun Mfg. & Eng. Corp., New York City, N. Y.—revolving, gravity, pulsating, Maxton, conical—see page 172
Kent Mill Co., Brooklyn, N. Y.—vibrating and hexagonal revolving—see page 178
Lewistown Foundry & Machine Co., Lewistown, Pa.—see page 189
Link-Belt Co., Chicago, Ill.—see page 152 and back cover
Littleford Bros., Cincinnati, O.
Ludlow-Saylor Wire Co., St. Louis, Mo.
Manganese Steel Forge Co., Philadelphia, Pa.—see page 181
McLanahan-Stone Machine Co., Hollidaysburg, Pa. —all kinds—see page 192
Link-Belt Meese & Gottfried Co., San Francisco, Calif.—cylindrical
Mine & Smelter Supply Co., Denver, Colo.—see page 59
National Engineering Co., Chicago, Ill.—vibrating
Newark Wire Cloth Co., Newark, N. J.
Nortmann-Duffke Co., Milwaukee, Wis.
The Orville Simpson Co., Cincinnati, O.—rotex, vibrating and shaking
Pittsburgh Perforating Co., Pittsburgh, Pa.—metal
Robins Conveying Belt Co., New York, N. Y.—see page 156
Rogers Foundry & Mfg. Co., Joplin, Mo.
Schaffer Engineering & Equipment Co., Pittsburgh, Pa.—see page 191
James B. Seaverns, Chicago, Ill.—shaking, vibrating, revolving—see page 196
Simplex Screen Co., Salt Lake City, Utah
Smith Engineering Works, Milwaukee, Wis.—see page 176
Southwestern Engineering Co., Los Angeles, Calif. —vibrating
The Stearns Conveyor Co., Cleveland, O.
Stearns-Roger Mfg. Co., Denver, Colo.
Stephens-Adamson Mfg. Co., Aurora, Ill.—see page 150
Stevenson Co., Wellsville, O.
Stimson Equip. Co., Salt Lake City, Utah—electrical vibrating
E. H. Stroud & Co., Chicago, Ill.
Sturtevant Mill Co., Boston, Mass.—round, hexagonal, vibrating—see page 182
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.—see front cover
W. Toepfer & Sons Co., Milwaukee, Wis.—revolving—see page 173
Traylor Eng. & Mfg. Co., Allentown, Pa.—see pages 44-45
Twin City Iron & Wire Co., St. Paul, Minn.—wire
The W. S. Tyler Co., Cleveland, O.—electrical vibrating and woven wire—see page 163
The Union Engineering Co., Cleveland, O.
United Iron Wks., Inc., Kansas City, Mo.—see page 13
Universal Crusher Co., Cedar Rapids, Ia.—see page 224
Universal Road Machinery Co., Kingston, N. Y.—see page 192
Universal Vibrating Screen Co., Racine, Wis.—see page 178
Webb City & Carterville Fdry. & Machine Works, Webb City, Mo.—trunnion and trommell—see page 192
Webster Mfg. Co., Chicago, Ill.—revolving and shaking—see page 27
Weller Mfg. Co., Chicago, Ill.—see page 176
Western Wheeled Scraper Co., Aurora, Ill.—revolving—see page 167
Wickwire Spencer Steel Co., Worcester, Mass.
Williams Patent Crusher & Pulv. Co., St. Louis, Mo.—see inside front cover
Worthington Pump & Machinery Corp., New York, N. Y.—see pages 18-19

### SCREENS (Shaking)

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 14
Jeffrey Mfg. Co., Columbus, O.—see pages 46-47
Orville-Simpson Co., Cincinnati, O.

### SEPARATORS (Air)

R. M. Gay Co., Inc., New York, N. Y.—see page 193

### SEPARATORS (Magnetic)

Dings Magnetic Separator Co., Milwaukee, Wis. —see page 151
S. Howes Co., Inc., Silver Creek, N. Y.—see page 196
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### SHEAVES

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Beach Mfg. Co., Charlotte, Mich.
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James H. Channon Mfg. Co., Chicago, Ill.
Clyde Iron Works, Duluth, Minn.
Conveyors Corp. of America, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.—see page 162
Godfrey Conveyor Co., Elkhart, Ind.
Gustafson Mfg. Co., Chattanooga, Tenn.
Hadfield-Penfield Steel Co., Bucyrus, O.—see page 171
The Geo. Haiss Mfg. Co., Inc., New York, N. Y.
Joshua Hendy Iron Works, San Francisco, Calif.
The Hill Clutch Co., Cleveland, O.—see page 195
Hockensmith Wheel & Mine Car Co., Penn, Pa.
Indiana Foundry Co., Inc., Indiana, Pa.
Inland Engineering Co., Chicago, Ill.
Lake Shore Engine Works, Marquette, Mich.
Link-Belt Co., Chicago, Ill.—see page 152 and back cover
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Medart Co., St. Louis, Mo.
The Mining Machine Co., Mountville, Pa.—steel
Newhall Chain Forge & Iron Co., New York, N. Y.
Ottumwa Iron Works, Ottumwa, Ia.
Pettibone-Mulliken Co., Chicago, Ill.
John A. Roebling's Sons Co., Trenton, N. J.
Sanford-Day Iron Works, Knoxville, Tenn.
Schofield-Burkett Construction Co., Macon, Ga.
Vulcan Iron Works, Wilkes-Barre, Pa.—see page 186
The Webster Mfg. Co., Chicago, Ill.—see page 27
Weller Mfg. Co., Chicago Ill.—see page 176
Wellman-Seaver-Morgan Co., Cleveland, O.
Williamsport Wire Rope Co., Williamsport, Pa.

### SHIELDS (Eye, Face, Body)

Chicago Eye Shield Co., Chicago, Ill.
Electric Arc Cutting & Welding Co., Newark, N. J.
Pulmosan Safety Equipment Co., Brooklyn, N. Y.
Safety First Supply Co., Pittsburgh, Pa.

### SHOVELS (Steam)

American Hoist & Derrick Co., St. Paul, Minn.—steam—see page 197
Austin Machinery Corp., Toledo, O.—steam, gas and electric
Bay City Dredge Works, Bay City, Mich.
Brown Hoisting Machinery Co., Cleveland, O.—see page 1
Browning Co., Cleveland, O.—see page 53
Bucyrus Co., South Milwaukee, Wis.—all types—see page 20
Erie Steam Shovel Co., Erie, Pa.—see page 197
Industrial Works, Bay City, Mich.—combination crane-steam shovels—see page 185
Link-Belt Co., Chicago, Ill.—power-automatic—see page 152 and back cover
The Marion Steam Shovel Co., Marion, O.—steam, gasoline, electric, revolving, etc.—see pages 8-9
Northwest Engineering Co., Chicago, Ill.—gasoline—see pages 3-4
Orton & Steinbrenner, Chicago, Ill.—steam—see page 49
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Pawling & Harnischfeger Co., Milwaukee, Wis.—see page 39
The Thew Shovel Co., Lorain, O.—steam, gasoline and electric

### SHOVELS (Gasoline and Electric)

Austin Machinery Corp., Toledo, O.
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### SKIPS

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Earle C. Bacon, Inc., New York, N. Y.
C. O. Bartlett & Snow Co., Cleveland, O.
The Biehl Iron Works, Inc., Reading, Pa.
C. S. Card Iron Works Co., Denver, Colo.
Chain Belt Co., Milwaukee, Wis.
Denver Engineering Works, Denver, Colo.
Hendrick Mfg. Co., Ca bondale, Pa.—see page 200
Joshua Hendy Iron Works, San Francisco, Calif.
Jeffrey Mfg. Co., Columbus, O.—see pages 46-47
Koppel Industrial Car & Equipment Co., Koppel, Pa.—see inside back cover
Lake Shore Engine Works, Marquette, Mich.
Link-Belt Co., Chicago, Ill.—see page 152 and back cover
Penn Foundry & Mfg. Co., Reading, Pa.
Stearns-Roger Mfg. Co., Denver, Colo.
Traylor Eng. & Mfg. Co., Allentown, Pa.—see pages 44 and 45
Vulcan Iron Works, Wilkes-Barre, Pa.—see page 186
Webster Mfg. Co., Chicago, Ill.—see page 27
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### SLATE WORKING MACHINERY

S. Flory Mfg. Co., Bangor, Pa.—saw beds, planers, rubbing beds, grooving attachments—see page 180
Ruggles Machine Co., Poultney, Vt.
Sullivan Machinery Co., Chicago, Ill.—see page 179

### SOCKETS (Lamp)

The Cutler-Hammer Mfg. Co., Milwaukee, Wis.

### SPECIFIC GRAVITY APPARATUS (For Cement)

E. H. Sargent & Co., Chicago, Ill.

### SPEED REDUCERS

The Cleveland Worm & Gear Co., Cleveland, O.
Dodge Mfg. Co., Mishawaka, Ind.—see page 162
Falk Corp., Milwaukee, Wis.—see page 157
Foote Bros. Gear & Machine Co., Chicago, Ill.
Wm. Ganschow Co., Chicago, Ill.
Hill Clutch Co., Cleveland, O.—see page 195
D. O. James Manufacturing Co., Chicago, Ill.
W. A. Jones Fdry. & Machine Co., Chicago, Ill.
Mine & Smelter Supply Co., Denver, Colo.—see page 59
R. D. Nuttall Co., Pittsburgh, Pa.
A. Plamondon Mfg. Co., Chicago, Ill.
Poole Eng. & Machine Co., Baltimore, Md.
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### SPROCKETS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 14
American Manganese Steel Co., Chicago Heights, Ill.—see page 190
B. & W. Oil-less Conveyor Co., Chicago, Ill.
The Baldwin Chain & Mfg. Co., Worcester, Mass.
H. W. Caldwell & Son Co., Chicago, Ill.—see page 153
W. E. Caldwell Co., Louisville, Ky.
Chain Belt Co., Milwaukee, Wis.
Dodge Mfg. Corp., Mishawaka, Ind.—see page 162
Foote Bros. Gear & Machine Co., Chicago, Ill.
Hadfield-Penfield Steel Co., Bucyrus, O.—see page 171
The Geo. Haiss Mfg. Co., Inc., New York, N. Y.
Hesse-Ersted Iron Works, Portland, Ore.
Hill Clutch Co., Cleveland, O.—see page 195
Howe Chain Co., Muskegon, Mich.
Inland Engineering Co., Chicago, Ill.
The Jeffrey Mfg. Co., Columbus, O.—see pages 46 and 47
W. A. Jones Foundry & Machine Co., Chicago, Ill.
Link-Belt Co., Chicago, Ill.—see page 152 and back cover
The Medart Co., St. Louis, Mo.
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Morse Chain Co., Ithaca, N. Y.—silent chain
R. D. Nuttall Co., Pittsburgh, Pa.
Pettibone Mulliken Co., Chicago, Ill.
Robins Conveying Belt Co., New York, N. Y.—see page 156
Stroh Steel-Hardening Process Co., Pittsburgh, Pa.
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.—see front cover
Union Chain & Mfg. Co., Sandusky, O.
The Webster Mfg. Co., Chicago, Ill.—see page 27
The Weller Mfg. Co., Chicago, Ill.—see page 176

### STACKS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 14
The Biggs Boiler Works Co., Akron, O.
Brownell Co., Dayton, O.
Chicago Bridge & Iron Co., Chicago, Ill.
Duff Patents Co., Inc., Pittsburgh, Pa.
Heil Co., Milwaukee, Wis.
Hendrick Mfg. Co., Carbondale, Pa.—see page 200
The Houston, Stanwood & Gamble Co., Inc., Cincinnati, O.
Jackson & Church Co., Saginaw, Mich.—see pages 40 and 41
Littleford Bros., Cincinnati, O.
Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
The Reeves Bros. Co., Alliance, O.—see page 38
Standard Steel Works, North Kansas City, Mo.
Steacy-Schmidt Mfg. Co., York, Pa.
Traylor Engineering & Mfg. Co., Allentown, Pa.—see pages 44-45

### STEAM ENGINES

See Engines

### STEAM SHOVEL REPAIR PARTS

American Manganese Steel Co., Chicago Heights, Ill.—see page 190
Bucyrus Co., South Milwaukee, Wis.—see page 20
Hadfield-Penfield Steel Co., Bucyrus, O.—see page 171
Inland Engineering Co., Chicago, Ill.
Moore & Moore, Inc., Reading, Pa.
Philadelphia Steel & Iron Co., Philadelphia, Pa.
Stroh Steel Hardening Co., Pittsburgh, Pa.
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.—see front cover

### STONE GRAPPLE

Superior Iron Works, Superior, Wis.

### STONE SCRUBBERS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 14
Greenville Mfg. Co., Greenville, O.
Link-Belt Co., Chicago, Ill.—see page 152 and back cover
Smith Engineering Works, Milwaukee, Wis.—see page 176
Stephens-Adamson Mfg. Co., Aurora, Ill.—see page 150

### STORAGE (Cement Silo)

Bland Eng. Co., Minneapolis, Minn.
MacDonald Engineering Co., Chicago, Ill.
F. L. Smidth & Co., New York, N. Y.—see page 195
Wert Mfg. Co., Chicago, Ill.

### STORAGE SYSTEM—Oil and Gas

S. F. Bowser & Co., Pittsburgh, Pa., Ft. Wayne, Ind.
Gilbert & Barker Mfg. Co., Springfield, Mass.
Wayne Tank & Pump Co., 797 Canal St., Ft. Wayne, Ind.

### STRUCTURAL STEEL WORK

The Austin Co., Cleveland, O.
Beach Mfg. Co., Charlotte, Mich.
Bethlehem Steel Co., Bethlehem, Pa.
Blaw-Knox Co., Pittsburgh, Pa.
Exeter Machine Works, Inc., West Pittston, Pa.
Gehret Bros., Inc., Bridgeport, Pa.
Hendricks Mfg. Co., Carbondale, Pa.—see page 200
Penn Bridge Co., New York, N. Y.
Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
United Iron Wks., Inc., Kansas City, Mo.—see page 13
Weller Mfg. Co., Chicago, Ill.—see page 176

### STUCCO FACINGS

Crown Point Spar Co., Inc., New York, N. Y.
Greenstone Products Co., Roanoke, Va.
The Metro-Nite Co., Milwaukee, Wis.
Middlebury Marble Co., Brandon, Vt.
Vermont Milling Products Corp., Poultney, Vt.—granules, chips

### SUPERHEATERS

Power Specialty Co., New York, N. Y.—air heaters, fuel economizers
The Superheater Co., New York, N. Y.—locomotives, power plants, steam shovels

### SWITCHES—Electrical

The Automatic Reclosing Circuit Breaker Co., Columbus, O.
Cutler-Hammer Mfg. Co., Milwaukee, Wis.
The Electric Controller & Mfg. Co., Cleveland, O.—automatic
General Electric Co., Schenectady, N. Y.—see pages 34-35
Ohio Brass Co., Mansfield, O.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.—see pages 36-37

### TANKS

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 14

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Allen Cone Co., El Paso, Texas—dewatering, sand washing, thickening, etc.
American Spiral Pipe Works, Chicago, Ill.
The Biggs Boiler Works Co., Akron, O.—steel storage pressure, high pressure, mixing and agitating, steam jacketed, pneumatic water supply, air receivers, condensers, evaporators, coolers, hot water, lead lined, creosoting, surge and underground
Blaw-Knox Co., Pittsburgh, Pa.
S. F. Bowser Co., Inc., Fort Wayne, Ind.—for gasoline and oil
The Brownell Co., Dayton, O.
W. E. Caldwell Co., Louisville, Ky.—wood, steel and galvanized
Chicago Bridge & Iron Works, Chicago, Ill.
L. R. Christie Co., Pittsburgh, Pa.—see page 48
Columbian Steel Tank Co., Kansas City, Mo.
Conveyors Corp. of America, Chicago, Ill.
The Dorr Co., New York, N. Y.
Duff Patents Co., Inc., Pittsburgh, Pa.
Erie City Iron Works, Erie, Pa.
Gilbert & Barker Mfg. Co., Springfield, Mass.
The Greenville Mfg. Co., Greenville, O.—steel, automatic and settling.
The Heil Co., Milwaukee, Wis.
Hendrick Mfg. Co., Carbondale, Pa.—see page 200
Littleford Bros., Cincinnati, O.
MacDonald Eng. Co., Chicago, Ill.—concrete
Manning, Maxwell & Moore, Inc., New York, N. Y.
McGann Manufacturing Co., Inc., York, Pa.—see page 15
Petroleum Iron Works Co. of Ohio, Sharon, Pa.—water
Pittsburgh-Des Moines Steel Co., Pittsburgh, Pa.
The Reeves Bros. Co., Alliance, O.—see page 38
Smith Eng. Works, Milwaukee, Wis.—sand—see page 176
Standard Steel Works, North Kansas City, Mo.
Steacy-Schmidt Mfg. Co., New York, N. Y.
Stearns-Rogers Mfg. Co., Denver, Colo.
Sturtevant Mill Co., Boston, Mass.—see page 182
W. Toepfer & Sons Co., Milwaukee, Wis.—sand settling—see page 173
Traylor Eng. & Mfg. Co., Allentown, Pa.—see pages 44-45
United Iron Wks., Inc., Kansas City, Mo.—see page 13
United Lead Co., New York, N. Y.
Walsh & Widner Boiler Co., Chattanooga, Tenn.
Wayne Tank & Pump Co., Ft. Wayne, Ind.—storage tanks.
Weller Mfg. Co., Chicago, Ill.—see page 176
Wiederholdt Construction Co., New York, N. Y.
Youngstown Boiler & Tank Co., Youngstown, O.

### TANKS (Pressure)

Heil Co. Milwaukee, Wis.
Wm. B. Scaife & Sons Co., Oakmont, Pa.
Steacy-Schmidt Mfg. Co., New York, N. Y.

### TARPAULINS

Cleveland Akron Bag Co., Cleveland, O.
Upson-Walton Co., Cleveland, O.

### TEETH (Dipper)

American Manganese Steel Co., Chicago Heights, Ill.—see page 190
Hadfield-Penfield Steel Co., Bucyrus, O.—see page 171
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.—see front cover

### TESTING LABORATORIES

Geo. Borrowman, Ph.D., Chicago, Ill.
Robt. W. Hunt & Co., Chicago, Ill.—see page 198
H. Miscampbell, Duluth, Minn.—see page 23
H. Wiedeman, Chemist, St. Louis, Mo.

### TESTING MACHINERY

Braun Corp., Los Angeles, Calif.
Eimer & Amend, New York, N. Y.
Riehle Bros. Testing Machine Co., Philadelphia, Pa.
E. H. Sargent & Co., Chicago, Ill.
Thwing Instrument Co., Philadelphia, Pa.
Tinius Olsen Testing Machine Co., Philadelphia, Pa.

### TESTING SIEVES AND SHAKERS

Hendrick Mfg. Co., Carbondale, Pa.—see page 200
E. H. Sargent & Co., Chicago, Ill.
The W. S. Tyler Co., Cleveland, O.—see page 163

### THERMOMETERS
(See Pyrometers)

### THICKENERS
(See Agitators)

### TIGHTENERS (Automatic)

Hill Clutch Co., Cleveland, O.—see page 195

### TRACK EQUIPMENT

Aldon Co., Chicago, Ill.
American Frog & Switch Co., Hamilton, O.
Atlas Car & Mfg. Co., Cleveland, O.—see page 174
Bethlehem Steel Co., Bethlehem, Pa.
The Biehl Iron Works, Inc., Reading, Pa.
Birmingham Rail & Locomotive Co., Birmingham, Ala.
The Buda Co., Chicago, Ill.
C. S. Card Iron Works, Denver, Colo.
Central Frog & Switch Co., Cincinnati, O.
Cincinnati Frog & Switch Co., Cincinnati, O.
The Cleveland Railway Supply Co., Cleveland, O.
Co-operative Utilities Co., Philadelphia, Pa.
Easton Car & Construction Co., New York, N. Y.—see page 183
The Electric Controller & Mfg. Co., Cleveland, O.
Elliott Frog & Switch Co., East St. Louis, Ill.
Fairmont Mining Machinery Co., Fairmont, W. Va.
L. B. Foster Co., Pittsburgh, Pa.
M. K. Frank, Pittsburgh, Pa.
C. W. Hunt & Co., Inc., W. New Brighton, N. Y.
The Hyde & Co, Pittsburgh, Pa.
Hyman-Michaels Co., Chicago, Ill.—see page 193
International Clay Machinery Co., Dayton, O.
Koppel Industrial Car & Equipment Co., Koppel, Pa.—see inside back cover
Lakewood Eng. Co., Cleveland, O.
Maris Bros., Philadelphia, Pa.
Pettibone Mulliken Co., Chicago, Ill.
Weir Frog & Switch Co., Cincinnati, O.
Western Wheeled Scraper Co., Aurora, Ill.—see page 167

### TRACTORS

Adamson Motor Co., Birmingham, Ala.
Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 14
Atlas Car & Mfg. Co., Cleveland, O.—see page 174
Bates Machine & Tractor Co., Joliet, Ill.
Brookville Truck & Tractor Co., Brookville, Pa.—see page 189
Clark Tructractor Co., Chicago, Ill.—dump
Kansas City Hay Press Co., Kansas City, Mo.—see page 195
Traylor Eng. & Mfg. Co., Allentown, Pa.—see pages 44-45

### TRACK SHIFTERS

Lake Superior Loader Co., Duluth, Minn.

### TRAILERS

Easton Car & Const. Co., Easton, Pa.—see page 183
Miami Trailer Co., Troy, N. Y.

### TRANSFORMERS
(See Electric Motors)

### TRANSMISSION MACHINERY

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 14
The Baldwin Chain & Mfg. Co., Worcester, Mass.
W. E. Caldwell Co., Louisville, Ky.
The H. W. Caldwell & Sons Co., Chicago, Ill.—see page 153
C. S. Card Iron Works Co, Denver, Colo.
Chain Belt Co., Milwaukee, Wis.
Cleveland Worm & Gear Co., Cleveland, O.
Colonial Supply Co., Pittsburgh, Pa.
R. & J. Dick Co., Inc., Passaic, N. J.
Dodge Mfg. Corp., Mishawaka, Ind.—see page 162
J. B. Ehrsam & Sons Mfg. Co., Enterprise, Kan.—see page 157
Falk Corporation, Milwaukee, Wis.—see page 157
Fawcus Machine Co., Pittsburgh, Pa.
Foote Bros. Gear & Machine Co., Chicago, Ill.
Frost Drive Co., Worcester, Mass.
Wm. Ganschow Co., Chicago, Ill.
Gifford-Wood Co., Hudson, N. Y.
The Greenville Mfg. Co., Greenville, O.
Gruendler Patent Crusher & Pulverizer Co., St. Louis, Mo.
The Hanson Clutch & Machinery Co., Tiffin, O.
Hesse-Ersted Iron Works, Portland, Ore.
The Hill Clutch Co., Cleveland, O.—parts—see page 195
Howe Chain Co., Muskegon, Mich.
Hyatt Roller Bearing Co., New York, N. Y.
W. A. Jones Fdry. & Machine Co., Chicago, Ill.
Kennedy-Van Saun Mfg. & Eng. Corp., New York, N. Y.—see page 172
Link-Belt Co., Chicago, Ill.—see page 152 and back cover
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Medart Co., St. Louis, Mo.
Mine & Smelter Supply Co., Denver, Colo.—see page 59
W. F. Mosser & Son, Allentown, Pa.
Morse Chain Co., Ithaca, N. Y.
Munson Mill Machinery Co., Inc., Utica, N. Y.—see page 193
Niles-Bement-Pond Co., New York, N. Y.
R. D. Nuttall Co., Pittsburgh, Pa.
Pettibone-Mulliken Co., Chicago, Ill.
Phillips Pressed Steel Pulley Works, Philadelphia, Pa.
Plamondon Mfg. Co., Chicago, Ill.
Poole Engineering & Machinery Co., Baltimore, Md.
Smith & Serrell, Newark, N. J.
Stearns-Roger Mfg. Co., Denver, Colo.
Sturtevant Mill Co., Boston, Mass.—see page 182
Tool Steel Gear & Pinion Co., Cincinnati, O.
Union Eng. Co., Cleveland, O.
Webster Mfg. Co., Chicago, Ill.—see page 27
Weller Mfg. Co., Chicago, Ill.—see page 176
Williams Pat. Crusher & Pulverizer Co., St. Louis, Mo.—see inside front cover

### TROLLEYS (Single I-Beam)

Curtis Pneumatic Mchy. Co., St. Louis, Mo.—see page 43

### TRUCKS (Car)

The Atlas Car & Mfg. Co., Cleveland, O.—see page 174
Bethlehem Steel Co., Bethlehem, Pa.
Brookville Truck & Tractor Co., Brookville, Pa.—see page 189
Easton Car & Construction Co., New York, N. Y.—see page 183
Gustafson Mfg. Co., Chattanooga, Tenn.
Hockensmith Mine Car Co., Penns, Pa.
Koppel Industrial Car & Equipment Co., Koppel, Pa.—see inside back cover
Lakewood Engineering Co., Cleveland, O.
Ottumwa Iron Works, Ottumwa, Ia.—patented roller bearings
Penn Foundry & Mfg. Co., Reading, Pa.
Sanford-Day Iron Works, Knoxville, Tenn.
Southern Wheel Co., St. Louis, Mo.
Watt Mining Car Wheel Co., Barnesville, O.
Western-Wheeled Scraper Co., Aurora, Ill.—see page 167

### TRUCKS (Road Maintenance)

Greenville Mfg. Co., Greenville, O.

### TUNNELING MACHINES

Hoar Shovel Co., Duluth, Minn.
Lake Superior Loader Co., Duluth, Minn.
Myers Whaley Co., Knoxville, Tenn.

### TURBINES

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 14
De Laval Steam Turbine Co., Trenton, N. J.—steam
General Electric Co., Schenectady, N. Y.—see pages 34-35
Moore Steam Turbine Corp., Wellsville, N. Y.
B. F. Sturtevant Co., Boston, Mass.
The Terry Steam Turbine Co., Hartord, Conn.
Westinghouse Electric & Mfg. Co., E. Pittsburgh, Pa.—see pages 36-37
Worthington Pump & Mach. Co., New York, N. Y.—see pages 18-19

### TURNTABLES

Atlas Car & Mfg. Co., Cleveland, O.—see page 174
Lakewood Eng. Co., Cleveland, O.
Steacy-Schmidt Mfg. Co., New York, N. Y.

### UNDERGROUND LOADERS

Hoar Shovel Co., Duluth, Minn.
Lake Superior Loader Co., Duluth, Minn.
Myers-Whaley Co., Knoxville, Tenn.

### USED EQUIPMENT

W. H. K. Bennett, M. E., Chicago, Ill.
Birmingham Rail and Locomotive Co., Birmingham, Ala.

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The Cameron & Barkley Co., Charleston, S. C.
Chicago Electric Co., Chicago, Ill.
The Cleveland Belting & Machinery Co., Cleveland, O.
J. F. Davis & Sons Co., Chicago, Ill.
H. R. Eicher, Pittsburgh, Pa.
M. K. Frank, Pittsburgh, Pa.
Great Lakes Equipment Co., Chicago, Ill.
The Greenville Gravel Co., Greenville, O.
W. P. Heineken Co., New York, N. Y.
The Hyde & Co., Pittsburgh, Pa.
Industrial Equipment Co., Chicago, Ill.
Kleinhans Co., Pittsburgh, Pa.
E. J. Lavino & Co., Philadelphia, Pa.
Machinery & Supply Co., Joplin, Mo.
National Belting & Salvage Co., Milwaukee, Wis.
Reading Engineering Co., New York, N. Y.
Ross Power Equipment Co., Indianapolis, Ind.
E. H. Wilson & Co., Philadelphia, Pa.
Zelnicker Supply Co., St. Louis, Mo.

### VALVES

Bay City Foundry & Machine Co., Bay City, Mich.
Cleveland Rock Drill Co., Cleveland, O.
Colonial Supply Co., Pittsburgh, Pa.
Crane Co., Chicago, Ill.
R. & J. Dick Co., Inc., Passaic, N. J.
Dixon Valve & Coupling Co., Philadelphia, Pa.
The Emerson Pump & Valve Co., Alexandria, Va.—see page 198
Jenkins Bros., New York, N. Y.
Kelly & Jones Co., Greensburg, Pa.
Knox Mfg. Co., Philadelphia, Pa.—see page 17
Lunkenheimer Co., Cincinnati, O.
Manning, Maxwell & Moore, Inc., New York, N. Y.
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Mine & Smelter Supply Co., Denver, Colo.—see page 59
Nelson Valve Co., Philadelphia, Pa.
Philadelphia Steel & Iron Co., Philadelphia, Pa.
Quaker City Rubber Co., Philadelphia, Pa.—see page 186
United Lead Co., New York, N. Y.
Victor Balata & Textile Belting Co., New York, N. Y.

### VIBRATING SCREENS

C. W. Hunt Co., West New Brighton, N. Y.
Link-Belt Co., Chicago, Ill.—see page 152 and back cover
Orville-Simpson Co., Cincinnati, O.
W. S. Tyler Co., Cleveland, O.—see page 163
Universal Vibrating Screen Co., Racine, Wis.—see page 178

### VICAT APPARATUS

E. H. Sargent & Co., Chicago, Ill.

### WAGONS

The Austin-Western Road Machinery Co., Chicago, Ill.—see page 177
The Greenville Mfg. Co., Greenville, O.
Troy Wagon Works, Troy, O.
Western Wheeled Scraper Co., Aurora, Ill.—dump—see page 167

### WASHERS

Allen Cone Co., El Paso, Texas
Allis-Chalmers Mfg. Co., Milwaukee, Wis.—see page 14
Diester Concentrator Co., Ft. Wayne, Ind.
Dorr Co., New York, N. Y.
Good Roads Machinery Co., Inc., Kennett Square, Pa.—see page 164
Greenville Mfg. Co., Greenville, O.
Lewistown Foundry & Machine Co., Lewistown, Pa.—see page 189
Link-Belt Co., Chicago, Ill.—see page 152 and back cover
McLanahan-Stone Machine Co., Hollidaysburg, Pa.—see page 192
Smith Eng. Works, Milwaukee, Wis.—see page 176
Stephens-Adamson Mfg. Co., Aurora, Ill.—see page 150
The Stevenson Co., Westville, O.—screw
W. Toepfer & Sons Co., Milwaukee, Wis.—see page 173
H. R. Wahl & Co., Chicago, Ill.
Webster Mfg. Co., Chicago, Ill.—see page 27
Weller Mfg. Co., Chicago, Ill.—see page 176

### WASTE HEAT SYSTEMS

Edge Moor Iron Co., Edge Moor, Del.
Glamorgan Pipe Foundry Co., Lynchburg, Va.—continuous pulp
Wickes Boiler Co., Saginaw, Mich.

### WATER SOFTENING SYSTEMS

Wm. B. Scaife & Sons Co., Oakmont, Pa.
Scientific Boiler Chemical Works, Chicago, Ill.
Wayne Tank & Pump Co., Ft. Wayne, Ind.

### WEIGHING EQUIPMENT

Automatic Weighing Machine Co., New York, N. Y.
Bates Valve Bag Co., Chicago, Ill.
Richardson Scale Co., Passaic, N. J.—automatic—see page 188
Schaffer Eng. & Equipment Co., Pittsburgh, Pa.—see page 191
Western Engineering & Mfg. Co., Chicago, Ill.
Valve Bag Co. of America, Toledo, O.—see pages 54-55
Western Valve Bag Co., Chicago, Ill.

### WELDING AND CUTTING EQUIPMENT

Aeroil Burner Co., Inc., Union Hill, N. J.
The Alexander Milburn Co., Baltimore, Md.
Allan Mfg. & Welding Corp., Buffalo, N. Y.
Burke Electric Co., Erie, Pa.—see page 191
The Champion Blower & Forge Co., Lancaster, Pa.
O. H. Davidson Equipment Co., Denver, Colo.
Electric Arc Cutting & Welding Co., Newark, N. J.
General Electric Co., Schenectady, N. Y.—see pages 34-35
Goodman Mfg. Co., Chicago, Ill.
Imperial Brass Mfg. Co., Chicago, Ill.
The Lincoln Electric Co., Cleveland, O.
The MacLeod Co., Cincinnati, O.
Manganese Steel Forge Co., Philadelphia, Pa.—see page 181
Metal & Thermit Corp., New York, N. Y.
The Ohio Brass Co., Mansfield, O.
Oxweld Acetylene Co., Newark, N. J.
H. N. Strait Co., Kansas City, Mo.
Universal Oxygen Co., Sheboygan, Wis.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.—see pages 36-37

### WHEELS—Car

American Car & Foundry Co., Chicago, Ill.
American Manganese Steel Co., Chicago Heights, Ill.—see page 190
The Atlas Car & Mfg. Co., Cleveland, O.—see page 174
Baker Car Co., Harriman, Tenn.
Bethlehem Steel Co., Bethlehem, Pa.
The Buda Co., Chicago, Ill.—cast iron
C. S. Card Iron Works Co., Denver, Colo.
Easton Car & Construction Co., New York, N. Y.—see page 183
Fuller-Lehigh Co., Fullerton, Pa.—see page 22
Griffin Wheel Co., Chicago, Ill.
Gustafson Mfg. Co., Chattanooga, Tenn.
Hadfield-Penfield Steel Co., Bucyrus, O.—see page 171
Joshua Hendy Iron Works, San Francisco, Calif.
Hill Clutch Co., Cleveland, O.—see page 195
Hockensmith Wheel & Mine Car Co., Penn, Pa.
Kenova Mine Car Co., Kenova, W. Va.
Koppel Industrial Car & Equip. Co., Koppel, Pa.—see inside back cover
Lake Shore Engine Wks., Marquette, Mich.
Lobdell Car Wheel Co., Wilmington, Del.
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Ogden Iron Works, Ogden, Utah
Ottumwa Iron Works, Ottumwa, Ia.
Pennsylvania Casting & Machine Works, Pittsburgh, Pa.
Pettibone Mulliken Co., Chicago, Ill.
Sanford-Day Iron Works, Knoxville, Tenn.
Southern Wheel Co., St. Louis, Mo.
Stroh-Steel-Hardening Process Co., Pittsburgh, Pa.—sheave, car, crane track
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.—see front cover
Watt Mining Car Wheel Co., Barnesville, O.

### WINCHES AND CAPSTANS

American Hoist & Derrick Co., St. Paul, Minn.—see page 197
Bay City Foundry & Machine Co., Bay City, Mich.
W. H. K. Bennett, M. E., Chicago, Ill.
James A. Channon Mfg. Co., Chicago, Ill.
Chicago Pneumatic Tool Co., New York, N. Y.
Dobbie Foundry & Machine Co., Niagara Falls, N. Y.
The Erie Hoist Co., Erie, Pa.—motor truck
S. Flory Mfg. Co., Bangor, Pa.—see page 180
The Hadfield-Penfield Steel Co., Bucyrus, O.—see page 171
Joshua Hendy Iron Works, San Francisco, Calif.
Hyman-Michaels Co., Chicago, Ill.—see page 193
Indiana Foundry Co., Inc., Indiana, Pa.
International Motor Co., New York, N. Y.
Lidgerwood Mfg. Co., New York, N. Y.
Link-Belt Co., Chicago, Ill.—see page 152 and back cover
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Mining Machine Co., Mountville, Pa.
Ottumwa Box Car Loader Co., Ottumwa, Ia.—see page 187
Standard Steel Works, North Kansas City, Mo.
Superior Iron Works, Superior, Wis.
Thomas Elevator Co., Chicago, Ill.—see page 169
Universal Hoist & Mfg. Co., Cedar Falls, Ia.
Webster Mfg. Co., Chicago, Ill.—see page 27
Weller Mfg. Co., Chicago, Ill.—see page 176

### WIRE CLOTH

Audubon Wire Cloth Co., Audubon, N. J.
Buffalo Wire Works Co., Buffalo, N. Y.
Cleveland Wire Cloth & Mfg. Co., Cleveland, O.—see page 166
Ludlow-Saylor Wire Co., St. Louis, Mo.
Manganese Steel Forge Co., Philadelphia, Pa.—see page 181
Newark Wire Cloth Co., Newark, N. J.
Twin City Iron & Wire Co., St. Paul, Minn.
The W. S. Tyler Co., Cleveland, O.—see page 163
Wickwire-Spencer Steel Corp., Worcester, Mass.
G. F. Wright Steel & Wire Co., Worcester, Mass.

### WIRE ROPE

Cableway, Conveyor, Crane, Derrick, Dredge, Guy, Hoisting, Loading Machinery, Mining, Haulage, Steam Shovel

American Steel & Wire Co., Chicago, Ill.—see page 179
Armstrong Mfg. Co., Waterloo, Ia.—see page 180
Broderick & Bascom Rope Co., St. Louis, Mo.
O. H. Davidson Equipment Co., Denver, Colo.
Dodge Mfg. Corp., Mishawaka, Ind.—see page 162
Hazard Mfg. Co., Wilkes-Barre, Pa.
A. Leschen & Sons Rope Co., St. Louis, Mo.—see page 29
Link-Belt Co., Chicago, Ill.—see page 152 and back cover
Link-Belt Meese & Gottfried Co., San Francisco, Calif.
Macwhyte Co., Kenosha, Wis.
George C. Moon Co., Garwood, N. J.
Pittsburgh Mining Machinery Co., Pittsburgh, Pa.
John A. Roebling's Sons Co., Trenton, N. J.
Joseph T. Ryerson & Son, Inc., Chicago, Ill.
Upson-Walton Co., Cleveland, O.
Waterbury Co., New York, N. Y.
Wickwire Spencer Steel Corp., Worcester, Mass.
Williamsport Wire Rope Co., Chicago, Ill.

### WIRE ROPE ACCESSORIES

American Hoist & Derrick Co., St. Paul, Minn.—see page 197
American Steel & Wire Co., Chicago, Ill.—see page 199
Broderick & Bascom Rope Co., St. Louis, Mo.
O. H. Davidson Equipment Co., Denver, Colo.
Hazard Mfg. Co., Wilkes-Barre, Pa.
A. Leschen & Sons Co., St. Louis, Mo.—see page 29
Link-Belt Co., Chicago, Ill.—see page 152.
Macwhyte Co., Kenosha, Wis.
Geo. C. Moon Co., Garwood, N. J.
John A. Roebling's Sons Co., Trenton, N. J.
Sauerman Bros., Chicago, Ill.—see page 183
Upson-Walton Co., Cleveland, O.
Waterbury Co., New York, N. Y.
Wickwire Spencer Steel Corp., Worcester, Mass.
Williamsport Wire Rope Co., Williamsport, Pa.

### WIRES AND CABLES—Electrical

American Brass Co., Waterbury, Conn.
American Steel & Wire Co., Chicago, Ill.—see page 199
General Electric Co., Schenectady, N. Y.—see pages 34-35
Hazard Mfg. Co., Wilkes-Barre, Pa.
John A. Roebling's Sons Co., Trenton, N. J.
Standard Underground Cable Co., St. Louis, Mo.
The Wickwire Spencer Steel Corp., Worcester, Mass.

# Used Equipment

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Complete outfit for 1-in. manila rope drive consisting of 1—36-in. sheave, 3 grooves; 1—48-in. sheave, 3 grooves; 1—48-in. sheave, 1 groove; 1—36-in. double yoke four wheel horizontal tension carriage.

1—Dean Brothers' horizontal, durable, duplex, double-acting brass-fitted piston type pump, having
8-in. steam cylinders—7-in. suction;
8-in. pump cylinders—6-in. discharge,
12-in. stroke.

1—No. 3 Gates gyratory crusher.

1—Single stage American Well Works centrifugal belt driven pump; 5-in. suction—4-in. discharge; normal capacity 500 G.P.M.

1—Swaby centrifugal same as above.

300 to 400 ft. 4-in. and 5-in. pipe.

200 ft. 2½-in. and 3-in. pipe.

1—50-H.P. locomotive fire box type boiler.

All of this equipment in good condition—some used only one short season—offered on account power changed to electricity. Prices on application f.o.b. Riverton, Indiana.

**MEROM GRAVEL COMPANY**
**208 Indiana Trust Bldg. Indianapolis, Indiana**

## FOR SALE

One No. 4 McCully Crusher, bought new last year, only used a short time. Price $1500.00. One new all steel stiff leg derrick, 80 ft. boom, good for 10 ton, arranged for clamshell work.

**Mertes Machinery Company**
**246 Oregon Street, Milwaukee, Wisconsin**

## Mine Cars, Rails and Locomotives

We have a number of good, serviceable, standard gauge, second hand locomotives, and narrow gauged ones, for immediate shipment.

**M. K. FRANK**
**Frick Building Pittsburgh, Pa.**

## SOME MONEY SAVERS

Two 8x110 ft. Rotary Kilns (western delivery)
One 42x48 in. Traylor Jaw Crusher, never used
One 60 in. Gyratory Crusher; fine condition
One No. 10 McCully Gyratory; cheap
One all steel Pan Conveyor, 133 ft.
One Allis-Chalmers Jaw Crusher, 18x30 in.
Bucyrus Shovel, 1½ yd., $2000
Two 60 in. x 20 ft. Screens, with full steel frames

Inquiries for other equipment welcomed. Write or wire.

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**537 S. Dearborn St., Chicago**

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70 ton R.R. type STEAM SHOVEL, 2½ yd. bucket, exceptionally fast mover in rock digging; this shovel has been in operation less than eight working seasons. Low price for quick sale.

One 4B Gates Crusher

**Inland Crushed Stone Company**
**105 North Clark Street Chicago, Illinois**

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1—8x110 ft. Rotary Kiln with new Vulcan Gears
1—8x100 ft. New Vulcan Rotary Kiln

## GYRATORY CRUSHERS

1—No. 10K Allis Chalmers
1—No. 9K Allis Chalmers
3—No. 6K McCully
1—No. 5K Allis Chalmers
1—No. 5 Austin

## THE EQUIPMENT SALES COMPANY

**Nashville, Tenn.**

***"Wire us your requirements at our expense"***
***"If we don't have it we will get it"***

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DRYERS—Direct-heat rotary dryers, 3x25′, 3½x25′, 4x30′, 5½x50′, 6x60′ and 7x60′; double shell dryers, 4x20′, 5x30′ and 6x35′; steam-heated air rotary dryers, 4x30′ and 6x30′.

KILNS—Rotary kilns, 4x40′, 5x50′ and 6x70′, 6x100′, 7x80′ and 8x110′.

MILLS—6x8′, 6x5′, 5x4′, 3x3½′ pebble and ball mills; 3′ March mill; 42″, 33″ and 24″ Fuller-Lehigh mills; 4½x20′, 5x11′, 5x20′, 5½x22′ and 6x20′ tube mills; 7½x13″, 9x15″, 16x10″ and 12x26″ jaw crushers; one "Infant" No. 00, No. 0, No. 2, No. 3, and No. 9 Williams' swing hammer mills; one Kent type "G" mill; 24″, 36″ and 40″ cage mills; 3′ and 4½′, 6′ and 8′ Hardinge mills; 18x12″, 20x12″ and 30x10″ roll crushers; No. 0, No. 1 and No. 3 Sturtevant rotary crushers; one No. 2 Sturtevant ring roll crusher; 5 roll and 2 roll No. 1 and No. 000, No. 00 and No. 0 Raymond mills; one No. 3 and No. 4 and No. 7½ Telsmith breaker; one 36″ Sturtevant emery mill; one 3 roll Griffin mill; 60″ chaser mill.

SPECIALS—Five automatic package weighing machines; jigs; 6x8′, 6x5′ and 4x3′ Newaygo vibrating screens; Richardson automatic scales; 8′ and 10′ Emerick air separators.

Air compressors.

**W. P. Heineken, Engineer**
**95 Liberty Street, New York. Tel. Cortland 1841**

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50 pieces 1½-in. round hollow Drill Steel, 10 ft. to 25 ft. long; every piece straight, clean cut, 4 point ends. All good as new. Bargain.

**The General Equipment Company**
**P. O. Drawer 45 Syracuse, N. Y.**

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**⅝ YD. THEW "O" TRACTION**

Thoroughly rebuilt; attractive terms for quick sale.

**Walter A. Zelnicker Supply Co., St. Louis**
**Rails, Locomotives, Cars, Tanks, Pipe**

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3—72-ton 6-wheel switching locomotives
1—59-ton 6-wheel switching locomotive
2—42-ton Shay geared locomotives
2—70-ton Shay geared locomotives
1—24-ton Heisler geared locomotive.

**Numerous other items. Complete list furnished on request**

**Birmingham Rail & Locomotive Co.**
**Birmingham, Ala.**

## ROTARY DRYERS

30—New Direct Fired Rotary Dryers, 4'-0" diam., 30'-0" long. These Dryers were about to be put into operation as the Armistice was signed, and consequently were never used. We are offering them at a sacrifice, complete, with driving mechanism, furnace irons, grates, etc. Some are equipped with steam radiators for steam heated air drying.

**McDERMOTT BROS. CO.**
**Allentown, Penna.**

## For Sale

1—45-ton Brown Locomotive Crane
2—200-H.P. B. & W. Tubular Boilers
1—54" dia. Cutler Hammer Lifting Magnet
2—Bucyrus Steam Shovels; 1—1¾, 1—2½ yard
Send us your inquiries

**Consolidated Products Co., Inc.**
**15 Park Row New York City**

Want to purchase 10-yard and ¾- or 2-yard 36-inch gauge all-steel Koppel, Atlas or Lakewood two-way dump cars.

**Box 1731, care of Rock Products**
**542 S. Dearborn Street, Chicago, Illinois**

## FOR SALE

**SAUERMAN POWER SCRAPER**

Outfit complete, including Sauerman double friction drum Hoist, ¾-yard LeClair Scraper, Cables and all equipment for a 400-foot span. All new from factory and only slightly used.

**P. C. Thompson, Bristol, Va.**

## GYRATORY CRUSHERS

Nos. 10-9-7½ and 6 CRUSHERS
No. 3 Gates Portable Outfit

## ROLL CRUSHERS

18x30-in. McLanahan Single Roll
24x54-in. Traylor Crushing Roll
84x72-in. Edison Crushing Rolls

## JAW CRUSHERS

60x84-in. P. & M. Jaw Crusher
10x18-in. Jaw Crusher
24x36-in. Traylor Jaw Crusher
NEW 22x50-in. Jaw Crusher
15x24-in. P. & M. Jaw Crusher
12x15-in. Champion Portable Crusher
36-in. and 24-in. SYMONS DISC CRUSHERS

**Many Others—Send Us Your Inquiries**

**ROSS POWER EQUIPMENT CO.**
**Indianapolis, Ind.**

## For Sale

One 18x36 Farrell Jaw Crusher, first class condition, manganese fitted.

**INTERSTATE CRUSHED STONE CO.**
**Springfield, N. J.**

## WANTED

Second Hand Gyratory Crusher, Elevator, Screen, Reduction Crusher and Steam Shovel for Crushed Stone Plant—50 to 60 tons hourly capacity. In reply state condition of material and where located. Address

**"Crusher," Box 37, York, Pa.**

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Two Monarch Cross Compound Corliss Engines, size 16"x32"x42", built for 160 pound steam pressure, and 85 revolutions per minute. Manufactured by H. N. Strait Mfg. Co. Are in good condition. May be seen in operation. Address

**Kansas Portland Cement Company**
**1608 Federal Reserve Bank Building**
**Kansas City, Mo.**

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### Surplus Equipment

1—Class 24 Bucyrus Electric Dragline
2—10x16-in. Davenport, 36-in. ga. saddle tank locomotives
8—4-yd., 36-in. ga. K. & J. contractors' dump cars
1—600-ft. belt driven Ingersoll-Rand air compressor
1—200 hp., 440 v., 60 cy., 3 ph. electric motor
1—125 hp., 440 v., 60 cy., 3 ph. electric motor
1—30 hp., 440 v., 60 cy., 3 ph. electric motor
1—No. 1, 36 in. x 8 ft. O'Laughlin screen with 4 ft. extension
1—Whitcomb standard gauge, 12-ton gasoline locomotive

**For Prices and Particulars, Address**

**Box No. 1727, care of Rock Products**
**542 South Dearborn Street, Chicago, Illinois**

Have you a plant for sale? Do you wish to purchase a plant? Are you in need of a superintendent or manager? Are you looking for a position as plant superintendent or manager? Advertise your wants in these columns for quick results.

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**Located Two Miles from Easton, Pa., on Lehigh Valley Railroad and Connections with Five Other Lines**

This Slag is of a superior quality and suitable for highways, roofing and general concrete construction. This is the last desirable deposit of Blast Furnace Slag available in Eastern Pennsylvania.

For further particulars address

**FRANCIS E. WALTER, ATTY.**
**Easton, Pa.**

## Wanted—Superintendent

An experienced man capable of taking charge of a crushed stone plant. Having small amount of capital to invest. Permanent position with a new plant ready to operate. Exceptionally good opportunity for right man. Address

**Box 1726 Care of Rock Products**
**542 South Dearborn Street Chicago, Ill.**

## FOR SALE
### Silica Sand Plant and Quarry

Modern electrical plant located in Eastern Pennsylvania. Along main line of P. & R. Railway. Developed and on a paying basis.

**Box 1729, Care of Rock Products,**
**542 South Dearborn Street Chicago, Illinois**

## WANTED

Position as superintendent of gravel washing plant by a man 35 years old, with 16 years' experience in gravel business, seven years as superintendent; thoroughly understands production end. Open for engagement January 1, 1924.

**Address Box 1723, care of Rock Products**
**542 South Dearborn Street Chicago, Illinois**

## WANTED

Man who has held position of manager or assistant manager of rock or gravel crushing plant, familiar with the operation of all types of crushers and screens, to travel and sell machinery. In reply give age, experience, salary wanted and a complete outline of the types of crushers you have operated. Address

**Box 1728, Care of Rock Products**
**542 South Dearborn Street Chicago, Ill.**

**WHITE CRYSTAL MARBLE QUARRY AND MILL FOR SALE—IDEAL MARBLE FOR STUCCO DASH**

A fully developed White Crystal Marble Quarry and Mill in New York State. Quarry contains 65 acres, all marble. This quarry is exceptionally sound and uniform in color and the white crystals in it make it most desirable for Stucco Dash. The equipment is complete for both quarry and mill. Reason for selling, have many other large contracts and cannot give this one my time. Address answer,

**Box 1713, Care of Rock Products**
**542 South Dearborn Street Chicago, Ill.**

Mining Engineer with fifteen years' experience solicits inquiry from quarry operators contemplating replacing open pit by mining methods. Object, temporary or permanent connection.

**Box 1730, care of Rock Products**
**542 S. Dearborn St. Chicago, Ill.**

## WANTED—POSITION

As superintendent crushing plant; 20 years' experience steam shovel operations; efficient management and organization essential to production. Address

**Box 1725 Care of Rock Products**
**542 South Dearborn Street Chicago, Ill.**

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## On Your Pay Roll Will Yield Big Returns

because its design and working principles are based on economy of operation and long life. It will be a **NO-STOP** worker, **strong, durable, simple, easy to install,** and when installed will give day-in and day-out service without troublesome delays.

### Heavy Duty General Crushers for Pit and Quarry

**For Boulders, Trap Rock** and all Hard Stone. 12x20 in., 12x24 in., 12x36 in. Capacities 75 to 350 tons daily.

**For Granite, Limestone** and similar materials, 15x20 in., 15x24 in., 15x36 in. Capacities 100 to 450 tons daily. Adjustment to crush to all commercial sizes.

Heavy Duty General Crushers

## Regular Equipment

Reversible Manganese Steel Jaws, Steel Split Pitman, Heavy High Carbon and Alloy Steel Shafts, Phosphor Bronze Bearings, Ring Oilers, Safety Toggle, Simple and rapid adjustment which can be made while the machine is running.

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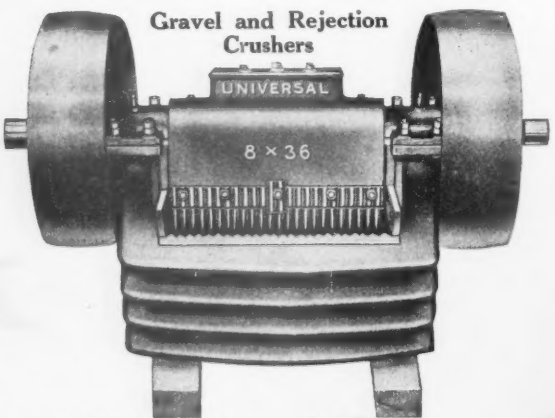


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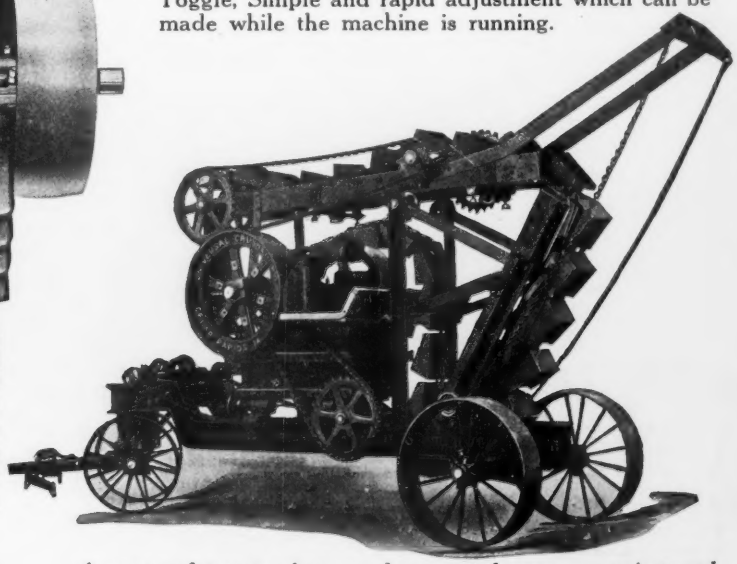

*Any one of twenty sizes can be mounted on a convenient and practical STEEL truck with or without elevators of the folding type*

***Write Us Your Requirements***

**UNIVERSAL CRUSHER CO., 225 3rd St., Cedar Rapids, Iowa, U.S.A.**



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